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## THE IRON ORES OF LAKE SUPERIOR

CONTAINING SOME FACTS OF INTEREST RELATING
TO MINING AND SHIPPING OF THE ORE AND
LOCATION OF PRINCIPAL MINES

WITH ORIGINAL MAPS OF THE RANGES

 $\mathbf{BY}$ 

CROWELL & MURRAY
CHEMISTS AND METALLURGISTS

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#### **Preface**

Much of the information contained in this book has appeared in the various trade journals, geological reports, and scientific society transactions.

Such widely scattered information, however, is of little practical use and our idea in presenting this book is that a compilation of such scattered facts would be appreciated by those interested in Lake Superior Ores.

In addition to this, we have secured the latest descriptions of most of the mines on the different ranges, and have worked out maps showing their exact location.

We are indebted to the various mine owners and ore sales agents for giving freely the information sought.

We shall be grateful for any criticisms, either as to statements or statistics, in which we may be in error, that such mistakes may be corrected in future editions of the book.

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Maps Showing Location of Ore Ranges and of Upper and Lower Lake Ports.

Vermillion Range. Crystal Falls District.
Gogebic Range. Marquette Range.
Menominee Rang. Mesabi Range.

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#### **HISTORY**

The early history of the Lake Superior iron ore country has been carefully written up and it is not our purpose to go into the

details of this very interesting subject.

In 1816 the United States government began its very careful survey of the government lands in the Northwest Territory. The system adopted was simple and is based on the well known method of determining points by rectangular co-ordinates, the original being the intersection of two lines run at right angles. One line extending North and South is called the principal meridian and the one extending East and West is called the base line. The land is then laid out in townships which are six miles square, and each designated by a number, North or South depending as to whether they are North or South of the base line. The lines running North and South dividing the townships are called range lines and the territory between two of these lines is known as the certain range number, East or West, as the case may be, from the principal meridian.

The townships are laid out in sections a mile square and are numbered from one to thirty-six, the numbers beginning at the North-east section, running West six numbers, East six numbers, then West six numbers, East six numbers, and East six numbers, and ending at the Southeast section.

Each section is divided into four parts and each part, con-

taining 160 acres, is called a quarter section.

The first iron ore was discovered in Michigan in 1844 by a party of United States surveyors who, noticing the variations of

their magnetic needle, found ore near Teal Lake.

The first iron made in the Lake Superior region was in an old forge on Carp River five miles East of Negaunee, February 10th, 1848. This forge was operated for several years, its largest production being three tons in one day.

The first shipment of ore from the Lake Superior region was made July 7, 1852, when 6 barrels of ore were sent to New

Castle, Pennsylvania.

In 1855 the first ship canal around the rapids at Sault Ste. Marie was completed. In 1856 the Marquette Range began ship-

ping regularly to the Lower Lake Ports.

The Menominee Range lies about fifty miles South of the Marquette Range. In 1873 the first ore was found on that Range, and in 1877 ore began to be sent out. The first actual cargo, however, was shipped from Milwaukee Nov. 11, 1884.

The Gogebic Range lies about 100 miles West of the Marquette Range. In 1883 ore in paying quantities was first found at the Colby Mine, and in 1886 this Range began to ship regu-

larly.

Ore was discovered on the Vermillion Range at about the same time as on the Gogebic, and they both became shippers the same year, 1886. The Vermillion Range lies wholly in Minnesota, about 100 miles North of Duluth.

The Mesabi Range lies about thirty miles South-west of the Vermillion Range in the State of Minnesota. It began to ship ore in 1892, and owing to the large bodies of ore, and the ease with which it can be taken out, it has become the largest shipper of ore of any of the Ranges.

The Cuyuna Range, located about ninety miles West of Duluth, is the youngest iron ore range in the Lake Superior

region.

In 1903, a low grade magnetite was discovered near Deerwood, Minnesota, and later hematite deposits were shown to exist. There has been considerable exploration work done on the Range since, and in 1911, it is expected that the Range will become a shipper of ore.

The Baraboo Range is located South of the central part of Wisconsin. Iron ore was first discovered in 1900 on this Range, and since 1904, the Range has been a regular shipper of ore.

The Michipicoten Range is, up to date, the largest shipper of ore in Canada. This Range is located on the Northern shore of Lake Superior, Northeast of Michipicoten Island. It was first opened up in 1897, as a gold mining district, but soon turned out to be far more valuable as an Iron Ore Range. The only shipping Mine is the Helen. This ore is used entirely in Canada.

The Moose Mountain Range is located about 30 miles North of Sudbury, in Ontario. It was first opened up in 1902. The only mine at present is the Moose Mountain, which began shipping

in 1908.

#### **GEOLOGY**

The geology of the Lake Superior region is complex and the following is only an outline of the more important features in the various ore bearing districts.

The principal ore bearing districts are known as the Marquette, Crystal Falls. Menominee, Gogebic, Mesabi and Vermillion. Others of less importance are the Baraboo, Cuyuna, Michipicoten and the Moose Mountain districts.

The ore bearing districts comprise a very small part of the whole Lake Superior region. They have been closely studied and the more important geological features have been identified for each district. The intervening areas are not so well known.

The ores occur in iron formations which are contained in rocks of pre-Cambrian age. They are due to the chemical action of underground water which has acted on the iron formation and

caused a re-arrangement of their iron contents and the formation of ore bodies.

The iron formations occur in both the Archean and Algonkian divisions of the pre-Cambrian rocks. They are all very similar and consist of chert or quartz, ferric oxide and small amounts of other iron bearing rocks. They represent the alterations from chemically deposited sediments which were derived from rocks that were rich in iron. This alteration is due to the chemical action of underground water and is most extensive where conditions have been such as to favor the circulation of underground water. The most important feature in connection with the alteration of the iron formation and the production of iron ore deposits is the presence of a relatively impervious rock within or at the base of the iron formations. Where this impervious rock has assumed the form of a trough enclosing the iron formation the alteration is extensive and the ore deposits are large. Where the trough is small, irregular, or broken, the alteration is less extensive and the ore deposits are small.

The alteration of the iron formations and the concentration of their iron contents into ore bodies was probably far advanced in pre-Cambrian time, for fragments of ore and of iron formation

are found in Cambrian sedimentary rocks.

The ore bearing districts are areas where the pre-Cambrian rocks are exposed. The oldest of these rocks, and probably the oldest rocks in the Lake Superior region are certain of the basic igneous rocks known as greenstones and green schists. Together with their associated slate and iron formation they are called Keewatin. Intrusive into these rocks and younger than they are,

are certain Laurentian granites and gneisses.

The Keewatin and Laurentian rocks make up the Archean division, or Basement Complex of the pre-Cambrian rocks. The upper division or Algonkian system is made up of four sedimentary series which are closely associated with igneous rocks. The three lower series consist of iron formations interbedded with slate and quartzite and are known as the Lower, Middle and Upper Huronian. The upper series is known as the Keweenawan. It consists of basic and acid igneous rocks interbedded with sand-stone and conglomerate. It contains no iron formation but forms the copper bearing series of Michigan.

The various iron formations are not all present and productive in any one locality. In the Vermillion and Michipicoten Districts, the productive formations are in the Keewatin division of the Archean. In the Mesabi, Gogebic and Menominee districts, the iron formations are a part of the Upper Huronian series. In the Marquette district two productive formations are present, one in the Middle Huronian and one in the Upper Huronian. In the Crystal Falls district the productive formations are in the Upper

and Lower Huronian series.

The iron formations are all very similar, but the factors which have controlled the underground circulation of water vary in the different districts. In the Mesabi district the impervious troughs consist of layers of slate or paint rock which are within the iron formation, but they are probably not as important as the topographical relation of the iron formation or as the folds in the iron formation which have furnished channels for the underground water.

In all of the other districts the presence of impervious troughs seems to be the controlling factor in the deposition of ore bodies. In the Vermillion district these troughs are formed of greenstone which encloses the iron formation. In the Gogebic district the impervious troughs are formed by the intersection of diorite dikes and quartzite. In the Marquette district the impervious basement is formed by greenstone which is intrusive into the iron formation, or by slate at the bottom of the iron formation. In the Menominee district the impervious troughs are formed by dolomite underlying the iron formation or by layers of slate within the formation.

The ores were all deposited in a hydrated condition but have been partially dehydrated and vary in the different districts from hard to soft ores. The hard ores are dehydrated and may be classified as red, blue, and micaceous hematite, magnetite and martite. The soft ores are limonite and hematite which is partially hydrated.

With very few exceptions the ore deposits lie either on the slopes or at the foot of conspicuous ranges or hills and it is believed that the present topographic features are the same as when the ore bodies were deposited. This relation is especially important in the Mesabi district and accounts for the formation of the ore bodies.

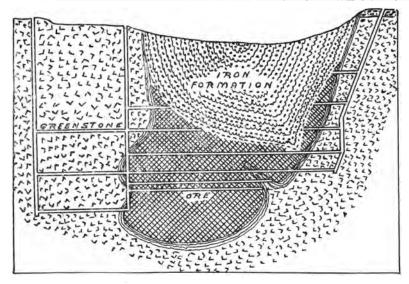
#### VERMILLION RANGE.

The Vermillion District lies in Northern Minnesota and includes the towns of Tower, Soudan and Ely.

The productive formation is the Soudan in the Keewatin division of the Archean. It occurs in narrow belts which are enclosed in greenstone. The whole district is one of complex folding. The ores are entirely hard blue and red hematites. They occur at or near the contact of the Soudan formation with the greenstone, and owing to the steep pitch the outcrops are small.

The depths of some of the mines are as follows:

Chandler 900 feet; Pioneer 1,261 feet; Savoy 857 feet; Sibley 1,281 feet; Soudan 1,249 feet; Zenith, 1,100 feet.

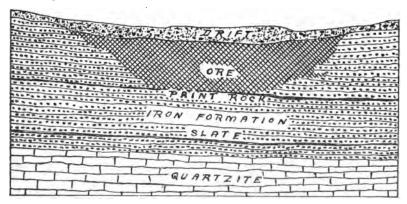


Vertical Section through Vermillion Ore Deposit and Adjacent Rocks; Chandler Mine, Ely, Minn.

#### MESABI RANGE.

The Mesabi District is Northwest of Lake Superior. It lies wholly in the State of Minnesota, and extends approximately 100 miles in an East and West direction. The principal towns are Biwabik, Sparta, Eveleth, Virginia, Mountain Iron, Hibbing, Nashwauk and Coleraine.

The iron formation is the Biwabik in the Upper Huronian. It lies along the Southern slope of a ridge which is known as the



Generalized Vertical Section through Mesabi Ore Deposit and Adjacent Rocks.

Giants or Mesabi Range and has a gentle slope towards the South. At about the center of the District, near Virginia, Eveleth and Sparta, the formation takes a relatively sharp bend, which is locally known as "The Horn." Transverse to the general trend of the iron formation are a series of folds, which have been the chief factors in the formation of ore bodies.

The slope of the iron formation is gentle and the ore deposits have a very gentle pitch as compared with the ore bodies in the other districts. While there is seldom any surface indications of ore, the ore bodies have great horizontal area and are usually covered with so little drift that the common method of the district is to strip off the drift and load the ore to the cars with steamshovels.

The ores are mostly soft, hydrated hematite, although some limonite is found. They vary in texture fom very fine dust to fairly coarse, hard and granular ore. Towards the Western end of the district, layers of sand are often found interbedded with the ore, forming the so-called "sandy" ores which will have to be concentrated to form ore of commercial grade.

The Mesabi ore deposits are shallow. The depths of some of the mines are as follows:

Mahoning 125 feet; Minorca 86 feet; Albany 190 feet; Shenango 250 feet; Virginia 341 feet; Susquehanna 192 feet.

#### GOGEBIC RANGE.

The Gogebic District is a narrow belt South of Lake Superior which lies in Michigan and Wisconsin. The most important part of the District lies in Michigan, although about two-thirds of the formation extends into Wisconsin. The most important towns are Hurley, Ironwood and Bessemer.

The productive formation is the Ironwood in the Upper Huronian series. It occurs as a narrow belt which dips towards the North and has a crenulated outcrop due to a series of minor transverse rolls.

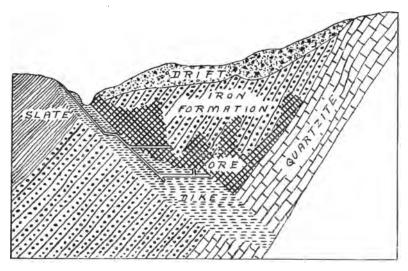
The formation rests on Upper Huronian quartzite and is cut by igneous dikes which combine with the quartzite to form impervious troughs in which the ore bodies were concentrated.

The ores are soft, red and partially hydrated hematites, with

subordinate amounts of hard. blue hematite.

The depths of some of the mines are as follows:

Ashland 1,324 feet; Norrie-Aurora 1,670 feet; Newport 2,200 feet; Ottawa 632 feet; Montreal 1,900 feet; Yale 1,780 feet.

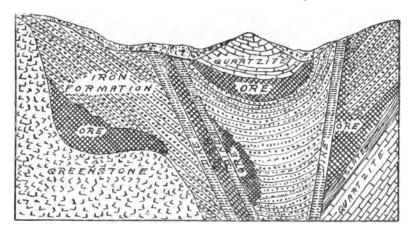


Generalized Vertical Section through Gogebic Ore Deposit and Adjacent Rocks.

## MARQUETTE RANGE.

The Marquette District is comparatively small. It lies in the State of Michigan and gets its name from the city of Marquette. The principal towns are Marquette; Ishpeming, Negaunee, Champion and Republic.

The iron formations occur in the Upper and Middle Huronian and the Keewatin division of the Archean. The productive forma-



Generalized Vertical Section through Marquette Ore Deposit and Adjacent Rocks.

tions are the Negaunee in the Middle Huronian and the Ishpeming in the Upper Huronian.

The ores are mostly soft, red hematites although the hardmicaceous hematites are important. Subordinate amounts of mag-

netite and limonite are found.

The district is cross folded so that the formations are irregularly distributed. In general the iron formation extends in an East and West direction, and the portions of the ore deposits that reach the surface are located on the middle or upper parts of the slopes. The outcrops of ore were conspicuous and led to the early discovery of this district. Some of the bodies are entirely below low lying areas, but in those cases are surrounded by impervious rocks.

The depths of some of the mines are as follows:

American 850 feet; Angeline 515 feet; Champion 2,292 feet; Hartford 1,075 feet; Princeton 383 feet; Republic 1,950 feet; Washington 572 feet.

#### MENOMINEE RANGE.

The Menominee District includes the towns of Iron Mountain, Quinnesec, Norway, Vulcan and Waucedah. It lies wholly in the

State of Michigan.

The productive iron formation is the Vulcan in the Uppe. Huronian series. It occurs in several narrow belts, all of which have a steep dip. The principal belt extends about twenty miles in an East and West direction. The formation, where productive, rests on the Lower Huronian dolomite and is covered by Upper Huronian slate. The Middle Huronian series has not been identified in the district.

The ores are mostly gray banded hematites, though subordinate amounts of silicious black and gray banded hematite are found.

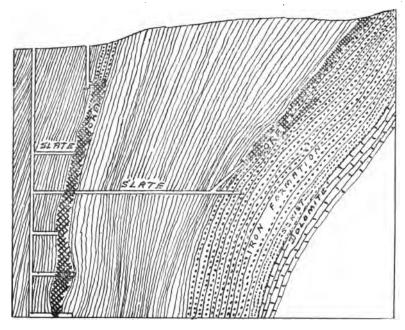
The depths of some of the mines are as follows:

Breen 258 feet; Chapin 1,522 feet; East Vulcan 1,400 feet; Loretto 800 feet; Millie 600 feet; Pewabic 941 feet; West Vulcan, Curry and Briar Hill 1,500 feet.

#### CRYSTAL FALLS DISTRICT.

The Crystal Falls District contains a greater area than any of the other ore bearing districts. The greater part of the district lies in Michigan and the remainder in Wisconsin. The principal towns are Florence, Commonwealth, Mansfield, Crystal Falls, Amasa and Iron River.

The iron bearing formations occur in the Upper and Middle Huronian, and are respectively known as the Michigamme and the Negaunee formations. The ores are mostly soft, red hematite, although in places they are hydrated and classed as limonite.



Generalized Vertical Section through Menominee Ore Deposit and Adjacent Rocks.

The district includes the Metropolitan, Commonwealth, Florence and Iron River areas. It is usually included with the Menominee district in the figures for the production of iron ore.

The structural geology is complicated and no effort is made to give an outline of it.

The depths of some of the mines are as follows:

Bristol 900 feet; Baltic 553 feet; Florence 700 feet; Hemlock 935 feet; Hiawatha 665 feet; Hollister 500 feet; Mansfield 1,189 feet.

#### BARABOO DISTRICT.

The Baraboo District is an outlier of the Lake Superior pre-Cambrian rocks which is found in South central Wisconsin. The principal town is North Freedom.

The iron formation is similar to the Middle Huronian but has not been positively identified. The ores are hematite with soft earthy, hard and black, and banded silicious phases. They are stratified and have the same strike and dip as the associated rocks which are found dipping at various angles from nearly horizontal to nearly vertical.

The depth of the Illinois Mine is 475 feet.

#### CUYUNA RANGE.

The Cuyuna Range is located in Crow Wing County in North Central Minnesota. The principal towns are Deerwood, Brainerd and Aitkin.

The iron formation occurs in two belts which have a general Northeast and Southwest direction. It has not been definitely identified and may belong to the Archean Middle Huronian or Upper Huronian age.

#### MICHIPICOTEN DISTRICT.

The Michipicoten District lies in Canada on the Northeast shore of Lake Superior. The only productive mine is the Helen which is situated twelve miles from Michipicoten Harbor.

The iron formation is practically equivalent to that in the Vermillion District and is found in the Keewatin division of the The ore is a mixture of hematite and limonite and originally extended in considerable areas to the rock surface. The present depth of the mine is 480 feet.

#### MOOSE MOUNTAIN DISTRICT.

The Moose Mountain District is located in Canada. Only one mine is productive. It is twenty-five miles North of Sudbury and is eighty miles by rail from Key Harbor on Georgian Bay.

The ore occurs in the Keewatin division of the Archean. It is mostly finely crystallized magnetite, although it contains a little hematite. It varies from high-grade ore to material which it is necessary to concentrate. The ore is mined by open cut.

#### MINERALOGY

The minerals described are:

Carbonate

Sulphides

Oxides Hematite, Fe<sub>2</sub> O<sub>8</sub> Hexagonal Isometric Martite, Fe<sub>2</sub> O<sub>3</sub> Isometric Magnetite, Fe<sub>3</sub> O<sub>4</sub> Ilmenite, (Fe Ti)<sub>2</sub> O<sub>3</sub> Limonite, Fe<sub>2</sub> (OH)<sub>6</sub> Fe<sub>2</sub>O<sub>3</sub> Hexagonal

Hydroxides Turgite, Fe<sub>4</sub> O<sub>5</sub> (OH)<sub>2</sub>

Goethite, Fe O(OH) Siderite, Fe CO<sub>3</sub> Orthorhombic Hexagonal

Pyrite, Fe S, Isometric Pyrrhotite, Fe<sub>6</sub>S<sub>7</sub> to Fe<sub>11</sub>S<sub>12</sub> Hexagonal Marcasite, Fe S<sub>2</sub> Orthorhombic

The principal iron ores are hematite, limonite, magnetite and Turgite and goethite are commercially included with The residues from roasting the sulphides for sulphuric limonite.

acid manufacture are sometimes used as a source of iron, and some ilmenite is smelted with other ores.

#### HEMATITE.

Composition: Fe<sub>2</sub> O<sub>3</sub> contains 70.00% iron.

Description: Occurs in masses which are compact, granular, or sometimes micaceous and as loose pulverulent earth. It varies in color from brilliant black metallic to brick red. In all varieties the streak on porcelain is red. The hardness varies from 5.5 to 6.5 and the specific gravity from 4.9 to 5.3.

#### MARTITE.

Composition: Fe<sub>2</sub> O<sub>3</sub> contains 70.00% iron.

Description: Differs from hematite in nothing but form. It occurs in octahedrons which it is supposed were derived from the oxidation of magnetite.

#### MAGNETITE.

Composition: Fe<sub>3</sub>O<sub>4</sub> contains 72.4% iron.

Description: A black mineral with a black streak on porcelain, and metallic lustre, strongly attracted by the magnet and occuring in all conditions from loose sand to compact coarse or fine grained masses. The hardness varies from 5.5 to 6.5 and the specific gravity from 4.9 to 5.2.

#### ILMENITE (Iron Titanium Compound).

Composition: (Fe Ti)<sub>2</sub>O<sub>3</sub>, composition variable.

Description: An iron black mineral usually massive, and in thin plates, imbedded grains, or as sand. The streak on porcelain is black to brownish red. The hardness varies from 5 to 6 and the specific gravity from 4.5 to 5.

## LIMONITE.

Composition: Fe<sub>2</sub>(OH)<sub>6</sub>Fe<sub>2</sub>O<sub>3</sub> contains 59.8% iron.

Description: Varies from loose porous bog ore and ochre to compact varieties which often have a black varnish like surface and a fibrous radiated structure. It is recognized principally by its yellowish brown streak on porcelain and absence of crystallization. The hardness varies from 5 to 5.5 and the specific gravity from 3.6 to 4.

#### TURGITE.

Composition: Fe<sub>4</sub>O<sub>5</sub>(OH)<sub>2</sub> contains 66.2% iron.

Description: Nearly black and resembles limonite but has a brownish red streak on porcelain. The hardness varies from 5.5 to 6 and the specific gravity from 4.3 to 4.7.

#### GOETHITE.

Composition: FeO(OH) contains 62.9% iron.

Description: A yellow, red, or brown mineral occurring in distinct crystals often flattened, like scales, or needle like and grouped in parallel position; also occurs massive like yellow ochre. The streak on porcelain is yellow, or brownish yellow. The hardness varies from 5 to 5.5 and the specific gravity from 4 to 4.4.

#### SIDERITE.

Composition: FeCO<sub>3</sub> contains 62.1% iron.

Description: Occurs in granular masses of a gray or brown color, or may be black from included carbonaceous matter. The lustre is vitreous to pearly and the mineral is brittle. The streak on porcelain is white or pale yellow. The hardness is 3.5 to 4 and the specific gravity 3.8 to 3.9.

#### PYRITE.

Composition: FeS<sub>2</sub> contains 46.7% iron, 53.3% sulphur. Description: A brass colored metallic mineral frequently in cubic or other isometric crystals, or in crystalline masses; less frequently in non crystalline masses. The streak on porcelain is greenish black, the hardness 6 to 6.5 and the specific gravity 4.9 to 5.2.

#### PYRRHOTITE.

Composition: Fe<sub>6</sub>S<sub>7</sub> to Fe<sub>11</sub>S<sub>12</sub>, composition variable.

Description: Usually a massive bronze metallic mineral which is attracted by the magnet and can be scratched with a knife. The streak on porcelain is grayish black, the hardness 3.5 to 4.5 and the specific gravity 4.5 to 4.6.

#### MARCASITE.

Composition: FeS<sub>2</sub>. Same as pyrite.

Description: Differs from pyrite in nothing but form. Crystallizes in orthorhombic forms which have received the names of cockscomb pyrites, spear pyrites, etc. The streak on porcelain is nearly black, the hardness 6 to 6.5 and the specific gravity 4.6 to 4.9.

#### MINING METHODS

The mining methods of the Lake Superior region combine the use of the most efficient mechanical appliances with great natural advantages as to the size and purity of the ore bodies. The natural result is that a maximum of ore is mined at a minimum expense.

The ore comes from a great many different mines, and individual mines show great variations as to the character and accessibility of the ore. In some cases the ore is extremely hard and difficult to mine, and in other cases it is very soft. In some cases it occurs in great beds which are covered only with glacial drift and can be mined from the surface, and in other cases it occurs at great depths and must be mined by underground methods. In any case, preliminary explorations allow the use of carefully planned systems, and the mining methods are cheap and effective.

At the present time, approximately two-thirds of the Lake Superior ore comes from the Mesabi range, due to the ease with which the Mesabi ores are mined. The ores are soft and friable and occur in shallow troughs which have a large horizontal area. In most cases they are covered only with glacial drift which varies in thickness from a few feet to a hundred feet or more.

The characteristic method of mining, on the Mesabi range, is to remove the glacial drift which covers the ore, and load the ore into railroad cars with steam shovels. This method is followed wherever conditions will permit, but a large portion of the Mesabi ores are mined by underground methods, known as caving and slicing systems, and a small portion is mined by a combination of surface and underground methods known as the milling system.

The method of mining on the Mesabi range is determined by the thickness of the covering over the ore, the size and form of the ore body, the facilities for approaching the ore, the available space for dumping the over-burden, and the capital available for stripping. These factors are determined previous to actual mining, and the propriety of mining in open pits or underground is established.

Where the conditions are favorable and the over-burden and ore are soft and uniform, it has been found economical to mine the ore by surface methods. The system varies in different mines. In some cases the tracks are laid down in the form of a spiral, with the lowest part in the center of the pit, and in other cases they are laid down on the various ore benches and converge to a common approach. In some cases, it has been economical to remove four or five tons of over-burden for every ton of ore in the deposit, and the pits vary in depth from 75 to 150 feet. In no case is it necessary to use cables to haul the loaded cars to the main track.

Where the conditions are less favorable, underground methods are resorted to and a large portion of the Mesabi ores are mined by the caving and slicing systems. The caving system consists in taking the ore from a series of levels connected with the main shaft which is usually located in the wall rock. The ore is taken from the upper levels, and delivered by chutes to the lower levels, which are securely protected. As the ore is removed from the upper levels, the roof is allowed to settle upon the ore below and the process is repeated until the bottom of the deposit is reached.

The slicing system is employed where there is a series of drifts, one advanced more than the other, so that the ore in the deposit is sliced off.

The milling system of mining is used for a small portion of the Mesabi ores. The over-burden is removed as in open pit mining, but instead of loading the ore into cars, it is broken into raises or mills which extend from underground workings to the surface of the ore. The ore is then transported to the shaft, which is usually placed in the wall rock, and is hoisted as in other underground methods.

On the other ranges the ores occur at greater depths and underground methods are generally used. In some cases the mine workings extend to a depth of 2000 feet and are still in ore, but in general, the ore is hoisted from depths that vary from 500 to 1500 feet. In some cases, the ore is soft and is capable of caving; in other cases it is hard and the caving system cannot be adopted. In some cases the ore is intermediate between hard and soft, and a combination of a caving system with some other method is necessary.

Where the ore is soft, a caving system is used. A shaft is sunk and haulage ways, as far as possible, are made in the solid rock. Raises are then driven to the top of the ore deposit and cribbed with two compartments, one for a ladder road and the other for the ore. The raises are spaced at intervals from 60 to 100 feet and sublevels are made to facilitate operations. When the raises are completed drifts are run parallel with the deposit and timbered with square sets; cross cuts are driven to both foot and hanging walls and the whole top of the ore body is drawn into the raises. The floor is then covered with planks and the timbers are blasted out so that the over-burden over the whole area is lowered. The process is then repeated with the exception that the over-burden is lowered after each slice is taken out, until the bottom of the deposit is reached.

Where the ore is hard and occurs in a narrow body which is steeply tilted, it is mined from a series of levels which connect with the shaft which is placed in the wall rock. When the ore is mined above a given level and is allowed to fall by gravity through chutes, or otherwise, it is known as overhand stoping. Where it is mined below a certain level and is raised to the level it is called underhand stoping. In most cases, the first named

method is the most advantageous. The workings are usually filled with waste rock in preference to maintaining timber.

Where the ore is intermediate between hard and soft, and occurs in a large body, a system is used that starts out as a square set system and develops a caving system as the work progresses. The shaft and haulage ways, as far as possible, are placed in the solid rock and the whole deposit is honeycombed, pillars of ore and rooms alternating on each level. The rooms are timbered with good substantial square set timbers. After the rooms are finished the pillars are removed. An upraise ir un up through the center of each pillar and timbered with the usual sets and the ore is broken down from the top and sent down the chutes in the outside sets. When the pillars have all been removed the timbers are blasted out, and the roof over the whole area is lowered.

A system called "scramming" is used on the levels below. Each level is divided into fifty foot squares, and in each square an upraise is run to the top of the ore. Drifts are then run each way from the bottom of the raise and the top of the square drawn into the raise. In this way the roof is allowed to settle over the whole square, and the process is repeated until all of the ore is mined.

#### TRANSPORTATION

The Lake Superior Iron Ores are carried by rail from the mines to the various loading docks on the Upper Lakes. The ore is moved to the Lower Lakes entirely by boat.

The first shipment of ore down the Lakes was in 1852, and consisted of five barrels of ore.

The largest cargo in 1856 was 400 tons; ten years later in 1866 the largest cargo was 697 tons; in 1876 the largest cargo was 1360 tons; and in 1886, 2450 tons were shipped in one vessel. In 1886 the first steel steamer, the "Spokane," 310 feet long, came out. The size of the cargoes gradually increased until 1895. During this year the first 400-foot boat, the "Auronia," came out and the largest cargo carried was 3,843 tons. In 1900 the first 500-foot boat came out and the size of the largest cargo was 7,450 tons. During the last ten years the size of the largest carriers has increased to over 600 feet, and in 1910 the largest cargo brought down the Lakes was 13,410 tons.

The unloading at the Lower Lake Ports is done by several types of unloading machines, and the ore is placed either directly on cars or on stockpiles for future shipments. At furnace plants located directly on the Lakes, the ore is unloaded from the boat directly on the Furnace stockpile. Ore for furnaces inland

is moved by rail from the Lake Ports.

Rail Freights on Iron Ore from the Mines to Lake Shipping Poi
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	Marquette	e Range	Menom- ince	Gogebi	c Range		Mesabi an	d Vermilli	T	
Year	•		Range	Wis.Cent.	C.&N.W				Two H	
	Marquette	Escanaba	Escanaba		R.R.	Duluth	Superior	Ely	Tower Soudarn	Other
1855	\$3.00									
1856	1.27		·							
1857	1.27				•					
1858	.87									
1859	.87									
1860	1.09									
1861 1862	1.09 1.09									
1863	1.09							•		`
1864	1.09									
1865	1.10									
1866	1.10	\$1.55								
1867	1.10	1.80								
1868	1.10	1.80			•					
1869	1.10	1.85								
1870	1.10	1.85								
1871	.95	1.70								
1872	.84	1.70								
1873 1874	.84 .84	2.00		•						
1875	.65	2.00 1.25								
1876	.55	1.15								
1877	.55	1.15								
1878	.55	1.15								
1879	.55	1.15								
1880	.55	1.25								
1881	.55	1.25								
1882	.55	1.25								
1883	.55	1.10								
1884	.40	.80								
1885	.45	.80								
1886 1887	.55 .55	.80 .80	\$0.85	\$0.80	\$0.80					
1888	.45	.70	.75	.70	.70					
1889	.45	.70	.75	.70	.70					
1890	.45	.70		.70						
1891	.45	.70	.70	.65	.65					
1892	.40	.65	.70	.65	.65	\$0.80.	\$0.80	\$1.00	\$0.90	\$0.80
1893	.40	.65	.70	.65	.65	.80	.80	1.00	.90	.80
1894	.32	.52	.70	.52	.65	.80	.80	1.00	.90	.80
1895	.32	.52	.52	.52	.52	.80	.80	1.00	.90	.80
1896	.32	.52	.52	.52	.52	.80	.80	1.00	.90	.80
1897 1898	.32 .32	.52 .40	.52 .45	.45 .40	.52 .45	.80 .80	.80 .80	1.00	.90 .90	.80 .80
1899	.32 .25	.40 .40	.43 .40	.40 .40	.43 .40	.80 .80	.80 .80	1.00 1.00	90	.80 .80
1900	.25	.40	.40 .40	.40 .40	.40 .40	.80	.80 .80	1.00	.90 .90	.80
1901	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1902	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1903	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1904	.25	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1905	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1906	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1907	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1908	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80
1909	.32	.40	.40	.40	.40	.80	.80	1.00	.90	.80

## Lake Freight Rates on Iron Ore from Ports Named to Lake Erie

YEAR	ESCANABA	MARQUETTE	ASHLAND AND OTHER PORTS AT HEAD OF LAKE SUPERIOR
1855		\$3.00	
1033			
1856		3.00	
1857		2.67	
1858		2.09	
1859		2.00	
1060		2.00	
1860		2.21	
1861			
1862		2.89	
1863		3.19	
1864		3.37	
1865		3.23	
1866	\$3.77	4.17	
1867	3.28	2.98	
1060	2.44	3.11	
1868			
1869	2.43	3.21	
1870	2.40	3.06	
1871	2.07	2.83	
1872	2.50	3.59	
1873	2.74	3.44	
1874	No shipment	3.84	
		2.87	
1875	No shipment		
1876	No shipment	2.54	
1877	No shipment	1.40	
1878	.85	1.26	
1879	1.07	1.61	
1880	1.77	2.50	
1881	1.55	2.25	
1001	1.22	1.50	
1882	1.11	1.30	
1883			
1884	.98	1.21	<b>41</b> 00
1885	.84	1.01	\$1.20
1886	1.16	1.35	1.49
1887	1.49	1. <b>7</b> 5	2.11
1888	.97	1.22	1.34
1889	1.00	1.14	1.29
1890	.99	1.16	1.26
1090	.99 .74	.96	1.05
1891			
1892	.87	1.06	1.20
1893	.70	.85	.88
1894	.53	.70	.79
1895	.64	.83	.96
1896	.61	.80	.91
1897	.45	.60	.63
1898	.48	.60	.61
1899	.72	.84	.95
	.85	.94	1.05
1900		.74	.84
1901	.62		
1902	.59	.68	.76
1903	.63	.73	.83
1904	.54 •	.61	.70
1905	.60	.70	.76
1906	.60	.70	.75
1907	.60	.70	.75
	.50	.60	.65
1908		.60 .60	.65
1909	.50		
1910	.50	.60	.65

The cost of transporting the ore from the mines to the Lower Lake Ports includes the charge on the rail shipments from the mine to the dock and the charge on the boat shipment from the dock to the Lower Lake Ports.

The rail freight from the Marquette Range to Marquette in 1855 was \$3.00 per ton. In 1866 Marquette Range ore also began to be shipped to Escanaba. The freight rate was \$1.55 per ton. These rates were gradually reduced till 1899, when the rate to Marquette was 25 cts. per ton, and to Escanaba 40 cts. per ton. These rates were in force until 1905, when the Marquette rate was raised to 32 cts., the Escanaba rate remaining at 40 cts. These last rates are still in force.

The first freight rate for Menominee ore to Escanaba was 85 cts. per ton. This was in 1887. The rate was gradually reduced until 1899, when the present rate, 40 cts. per ton, went into effect.

In 1877, the rate from the Gogebic Range to Ashland was established at 80 cts. per ton. This was gradually reduced until 1898 when the present rate of 40 cts. per ton was established.

In 1892, the rates from the Vermillion and Mesabi Ranges were established as follows: Mesabi Range to Duluth 80 cts. per ton, to Superior 80 cts. per ton, to Two Harbors 80 cts. per ton, from Ely to Two Harbors \$1.00 per ton, from Tower and Soudan to Two Harbors 90 cts. per ton. These rates have remained the same up to date.

#### CLASSIFICATION OF ORES

In the early days of iron ore mining and up to within a comparatively few years, the ore from a certain mine was quite uniform in composition. The ore was known by the name of the mine which produced it, and the user of a particular ore one year, could be sure that the ore would be of the same composition the next year, and buy accordingly.

As the production increased from year to year, in order to supply the demand it became necessary to grade ores from the same mine according to their composition; and further, to mix ores from different mines to produce an ore of a certain composition. At the present time it is quite customary to ship several differently named ores from the same mine, and a mixture of ores from different mines under a particular name.

As soon as the above condition was brought about, it at once became necessary for the user to know the exact composition of the various ores, and to be certain, that in the case of a mixed ore, each cargo was or was not, up to grade.

The successful operation of a blast furnace depends largely on keeping the conditions, under which it is running, constant. These conditions are varied and many, and one of the principal ones is a regular burden of ore. At the beginning of the year the furnaceman figures out his requirements, using the analyses as guaranteed by the sellers of the various ores. He figures what limestone and coke he will require to flux the particular ores he is to use, and how much his pig iron will cost.

If, when the ore begins to come in, the analysis varies from what the furnaceman has calculated, it means trouble all around. He must increase or decrease the amount of coke and limestone used, he must raise or lower the blast temperature, and perhaps finally, not be able to make the grade of pig iron which

he expected to.

Briefly, the chemical reactions in a blast furnace are first, the formation of the gas, carbon monoxide, (CO), from the oxygen of the air and the carbon of the coke. This gas, coming in contact with ore, takes up oxygen from the ore, forming Carbonic Acid

(CO<sub>2</sub>) and leaving metallic iron behind.

The carbonic acid then comes in contact with more coke and is reduced again to carbon monoxide, which in turn again coming in contact with more ore, takes oxygen, again forming Carbonic Acid, leaving behind metallic iron. During these oxidizing and reducing reactions the impurities of the ore, namely: silica, alumina, lime, magnesia, phosphorus, manganese and sulphur are being formed into a slag through the presence of the limestone and intense heat. The slag being lighter in weight than the liquid iron, stays on top of the iron and is drawn off from the furnace through a tapping hole. The liquid iron is run off through a hole in the furnace.

Unfortunately all the impurities do not stay in the slag. Practically all of the phosphorus, quite a considerable amount of the sulphur, about three-quarters of the manganese, and more or less silicon, reduced from the silica, goes into the iron. All the alumina, lime and magnesia of the ore stay in the slag. Lime and magnesia to a certain extent, are desirable constituents of iron ores, because in using such ores in a blast furnace, less limestone is required to form a slag. Alumina is not so desirable. A small amount of manganese does no harm in an ore, the less sulphur the better, and the amount of phosphorus determines whether the ore is Bessemer or Non-Bessemer.

Strictly speaking, a Bessemer ore is one in which the phosphorus is low enough to make Bessemer iron, which latter is supposed to contain not over .100% phosphorus. Hence, theoretically, the maximum allowable phosphorus in a Bessemer ore, depends on the iron. A common way of expressing this is, that the numerical figures of the dry phosphorus percentage must not exceed the numerical figures of the dry iron percentage, that is, if the dry iron in an ore is 55%, the phosphorus should not exceed .055%. The phosphorus in a Bessemer ore may vary widely but

it is generally accepted in the trade that the maximum must not be over .060%.

All iron ore contains a certain amount of moisture as it comes from the ground. As the ore is unloaded at the furnace, this moisture will be more or less than it was at the mine, depending on whether it has been subjected to drying or wetting conditions.

Before the chemist determines the iron or any other constituent, the ore is dried at 100° C. which is the same as 212° F. This drying, of course, removes all the moisture from the ore, except that which is chemically combined. This is done in order that the sample shall be in a uniform physical state. If the ore was not dried two chemists would probably not be able to get the same results. For instance, in determining iron they would not have the same amount of ore in the weight taken because of more or less moisture present.

The furnaceman, however, is not so much interested in the "dry" analysis, because when the ore is weighed into the furnace, it contains more or less moisture. This is the reason why analyses are reported in both the "dry" and "natural" conditions. The "natural" represents the iron in the ore in the condition in which it was sampled. This "natural" analysis, of course, is a calculated one. For instance, the dry analysis shows the iron to be 60%, and the moisture 10%; subtracting the percentage of moisture from 100%, and multiplying the remainder by the "dry" iron, we have 54%, which is the "natural" iron in the ore. The same method of procedure gives the natural analysis of the other constituents of the ore, and in calculating a burden for a blast furnace, the natural analysis is used.

#### SAMPLING

In the very early days of iron ore industry, the sampling of the ore received very scant attention. The ore seller had samples of the ore in his office with their analysis, and the ore was bought for so much per ton, with the idea that the analysis of the ore bought would be the same as that of the sample in the sellers office.

After a time it was found that this analysis was not always the same and the seller was obliged to guarantee something. He then guaranteed that the iron in the ore dried at 212° F, would be a certain percentage. These guarantees did not always materialize and it soon became the custom to divide the selling price. by the guarantee, which gave a unit value, and from an average analysis of the buyer and seller, to pay for the ore on this unit basis.

After the soft iron ores came into the market, the question of moisture became prominent, and the guarantees were adjusted according to the iron in the natural condition, instead of in the dry ore. The same method of finding the unit value was carried out, and payment for the iron was made on this unit value.

Iron ore is now bought and sold almost exclusively on the sampling and analysis of an Independent Chemist. Each cargo is sampled separately, and the average of the cargo analyses is used

as a basis of settlement for the shipment.

There is probably nothing in connection with the handling of iron ore, which has been subject to more disputes, than the question of sampling. Much has been written about this matter and it has been clearly demonstrated that the subject is an extremely complicated one, and one in which higher mathematics is necessary to fully demonstrate.

The sampling of iron ore cargoes must necessarily be done by a class of men not familiar with higher mathematics, and as a rule, not capable at all times, of exercising proper judgment as

to the lump and fine, wet and dry ore.

An error in analysis can be detected by redeterminations, but

after the sample is once taken, it must stand right or wrong.

We do a large amount of this work and have given the question of sampling very careful consideration. It is our opinion, that the less left to the judgment of the sampler, the better. In other words, the nearer we can approach a mechanical sample, the more liable we are to get a correct average of the ore.

It is obvious that were we able to grind up a whole cargo, thoroughly mix and properly quarter, we could finally have left a small pile of ore representing accurately this particular cargo. Such a method of procedure not being practical, the question

arises, how can we best approach this ideal condition.

After much thought and investigation, the following method of sampling has been adopted; and is now used by all the Independent Chemists of Cleveland.

#### SAMPLING METHOD

## STANDARD METHOD FOR SAMPLING CARGOES OF IRON ORE AT LOWER LAKE PORTS.

A continuous sample shall be taken from all cargoes, the weight of the sample varying with the size of the cargo.

This sample shall be taken with a galvanized iron scoop  $3\frac{1}{2}$ " wide,  $2\frac{1}{4}$ " long and  $1\frac{1}{4}$ " deep, the handle 8" long; and with a hammer 12" long (the scoop holds approximately  $\frac{1}{2}$  pound).

It shall be the aim to take an equal bulk of ore from every point selected. When a lump is encountered a portion shall be

broken off equal in bulk to a scoopful of soft ore. In sampling cargoes no sample shall be taken from the original outside surfaces on account of the presence of foreign matter and an undue proportion of fines.

#### SAMPLING OF SOFT ORE.

The sampler shall enter any hatch and begin sampling when the unloading machines have exposed five or six feet of the face.

In order to keep the size of samples within reasonable bounds and to gauge this size to the size of the boat, the sampler shall on cargoes up to 3500 tons, begin sampling at a convenient point at the bottom of the face of the ore, and shall take one standard scoopful every two scoop lengths up the face of the ore to the top, and then shall move four scoop lengths to one side of the starting point before again sampling vertically. He shall continue in this manner keeping the above distances around the face of the ore to the place of beginning.

On cargoes from 3500 to 6000 tons, he shall use the two scoop lengths for vertical distances up the face of the ore, but move six scoop lengths horizontally.

On cargoes over 6000 tons, he shall use the two scoop lengths for vertical distances up the face of the ore, but move eight scoop lengths horizontally.

The sampler shall then enter the next hatch working, and proceed to sample in exactly the same way, and so continue in every hatch.

The sampler shall then begin over again in the hatch in which he first started and continue the sampling in all the hatches provided there has been sufficient ore removed in the hatches since the faces were sampled to expose fresh ore.

The sampler shall continue this method of sampling in each hatch worked, until there is less than one-tenth of the ore left.

In sampling horizontal surfaces, as in boats where scrapers are used, the sampler shall sample every two scoop lengths lengthwise of the boat, the spaces between the lines of sampling to be 4-6-8 scoop lengths, according to the tonnage as described before.

#### SAMPLING OF HARD ORE.

In sampling hard lump ore the sampler shall begin sampling, and use the same spacing as defined for soft ore, using hammer lengths instead of scoop lengths. At each point sampled he shall take lump or fine ore equal to one cubic inch. In taking this cubic inch, the sampler shall take an average from the lump from which the cubic inch is broken.

#### MOISTURE SAMPLE.

The moisture sample shall be taken from the standard sample in the following manner:

When as many cans of ore have been filled as the stage of unloading will permit, the lump ore shall be broken up and the entire amount of ore so far taken shall be mixed and quartered twice, and from the last quarters to be rejected one scoopful for each can in the original sample shall be put into the moisture can, provided the total number of scoopfuls taken will produce a moisture sample weighing about 20 lbs. In case a moisture sample of such weight is not produced, the sampler shall take two or more scoopfuls per can from the rejected quarters, enough to produce about 20 lbs.

The moisture sample shall at once be placed in a standard moisture can with tightly fitted cover. This shall be accurately weighed, dried at 100° C. until the weight is constant. The loss in weight will represent the moisture in the cargo.

At certain unloading points, it is desired of the consignee of the ore, that the entire sample shall be dried and crushed before any quartering is done. At such unloading points the moisture sample shall be taken as follows:

The sampler shall take one round from each hatch when it is one-half unloaded, three scoop lengths vertically and twelve scoop lengths horizontally, taking only ore from fresh surfaces which have not been exposed to sun or rain. It must be thoroughly mixed at once without breaking down, and 20 lbs. placed in a standard moisture can.

Whenever it is not practical to hold the entire sample until the close of the sampling, before mixing and quartering, it may be quartered at convenient stages of the sampling. This must be done each time exactly alike, by breaking down to one-half inch, mixing and quartering twice, thus preserving the proper proportion of the whole sample.

If in the final quartering the last two quarters exceed a can full, the ore shall be quartered again and one quarter rejected.

The sample may be quartered on the vessel, or may be taken to some other place suitable for that purpose. Samples must be shipped to the crushing plant in standard cans.

#### CAR SAMPLING.

Not less than ten equal sized samples are taken from each car. When cars are loaded with fine ore with piles in opposite ends, at least five samples are taken from each pile; the first one at the apex of the pile, and the other four at points symmetrically arranged around the sides of the pile, two-thirds of the distance

from the apex to the base of the pile or sides of the car. With cars loaded in the center, the system is the same, except that the center of the side of the pile lengthwise of the car, is the first point and the other four being symmetrically arranged around this point.

When the ten points are located in a car, each of them is supposed to represent a definite area, equal to one-tenth.of the ore surface of the car. If the car contains all fine ore, then ten equal sized samples are taken, one from each of the points. the car contains a mixture of fine and lump ore, with varying amounts of each in the areas included in the different divisions. then each area is judged separately and sampled accordingly. The fine and lump ore are taken each in its proper proportions, the former with the scoop, the latter being chipped, or selected small pieces being taken, each about the size of the first joint of the thumb. The combined sample of fine, chipped and selected pieces from each area, equals the amount taken were it all fine ore. If the contents of the car were all lump ore, the proper sized pieces were chipped from four or five of the lumps in each of the ten areas, making forty or fifty pieces from each car, the total amount of the chipped pieces from each of the areas equalling the amount that would be taken were it all fine ore. All samples of fine ore are taken from well underneath the surface to obtain the ore in its natural state.

This method is based primarily on the assumption that a small representative portion of ore taken from a large number of places in different parts of the cargo, will necessarily show the average composition of the cargo. Each year the Lake Superior ores are being more and more mixed, to establish certain grades. This mixture starts in the pockets of the loading docks, is continued as the various pockets are loaded in the boat, and further mixed as the ore is unloaded from the boat into cars or on stockpile, and again mixed as the ore is unloaded at its destination. It is in the case of the more or less mixed ores that the present standard method is particularly applicable. The Independent Chemists fully realize the importance of the sampling, and are ever ready to consider suggestions, whereby the present method may be improved.

### METHODS OF ANALYSES

The following rapid methods of analyses are in general use:

#### Determination of Moisture.

The ore samples are received from the boats in tightly covered tin cans. The sample for analysis weighs about thirty-five pounds, and that for moisture about twenty pounds. The entire

moisture sample is emptied out into a shallow pan  $24 \times 18 \times 2$  inches. The pan is first weighed and then the pan and wet ore are weighed together. The pan of ore is placed in an enclosed steam coil and subjected to  $212^{\circ}$  F. heat for about twelve hours or until the weight is constant. The pan and ore are then weighed, and from the loss in weight, the percentage of moisture is calculated.

The sample for analysis is treated in the same way, and the moisture calculated. This is for an approximate check on the action moisture determination. It generally runs from .2% to .1% lower than the moisture in the moisture sample. This is because the sample has been exposed more or less to the air on the boat.

# Crushing.

The sample for analysis after being dried is all put through a Gates Crusher, until it entirely passes through a ½" sieve. The sample is thoroughly mixed and quartered through a Braun Quartering Machine, to about ten pounds. This ten pounds is ground in steel rolls until it all passes a 20 mesh sieve. After thoroughly mixing, this is quartered through the same machine to about one-half pound. This one-half pound is divided into two equal portions, and one portion put through a 100 mesh sieve. This portion is used for analysis. The other portion is kept in a box in case any check determinations are necessary.

Before analysis, the entire sample is dried for one hour at 100° C., removed from the oven and kept in a dessicator.

IRON. Weigh one-half gram of the ore into a 150 c. c. beaker, add 10 c. c. of a mixture, (concentrated hydrochloric acid 3 parts, and stannous chloride 1 part), cover with a watch glass and heat slowly to boiling on a hot plate, agitating the solution. After boiling for one minute, the beaker is removed to a warm place on the hot plate and left standing until the solution is complete. When the residue in the beaker appears perfectly white, reduce with stannous chloride from a burette, until the solution becomes colorless; add three drops excess. Add 15 c. c. mercuric chloride solution and wash the contents of the beaker into a titration jar containing 100 c. c. to 150 c. c. of water and 25 c. c. of the manganous sulphate mixture. Titrate with potassium permanganate to the first pink color. The permanganate should be of such strength that 1 c. c. equals .005 gram of iron, or every c. c. should correspond to 1% iron, when one-half gram portion of the ore is taken.

#### SOLUTIONS.

# Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

# Manganous Sulphate.

480 grams manganous sulphate, 10700 c. c. water, 1 litre phosphoric acid (85%) and 2800 c. c. strong sulphuric acid.

# Permanganate Solution Values.

1 c. c. equals .005000 grams iron.

1 c. c. equals .002500 grams lime. 1 c. c. equals .001473 grams manganese.

1 c. c. equals .000814 grams phosphorus.

# Stannous Chloride.

375 grams dissolved in 1 litre of water and 1 litre of strong hydrochloric acid.

# Mercuric Chloride.

700 grams dissolved in 14 litres of water.

PHOSPHORUS. For Bessemer ores weigh five grams, for Non Bessemer ores weigh one gram into a 250 c. c. beaker. Add 50 to 75 c. c. concentrated hydrochloric acid, cover with a watch glass and heat gradually to boiling, holding this temperature until the ore appears to be completely dissolved. Slightly raise the cover glass by means of a glass hook and evaporate the solution gradually until the mass becomes nearly dry; do not bake. Cool and add 15 c. c. of concentrated nitric acid. Heat gently until all the brown fumes are removed. Add 20 to 30 c. c. of hot water and filter into an Erlenmeyer's Flask (500 or 600 c. c. capacity). Wash the residue six times with hot water. Ignite the residue very strongly in a platinum crucible and return it into the beaker in which the original solution was made. Moisten with water and add 5 c. c. of concentrated nitric acid. Evaporate slowly until almost dry (about 1 c. c.). Dilute with hot water and filter into the main filtrate, which has in the meantime been concentrated to a small bulk (about 80 to 100 c. c.). The residue is discarded. The solution is made alkaline with strong ammonia and the precipitate of iron is dissolved with a very slight excess of strong nitric acid. Heat to 70° C. and add 40 c. c. of molybdate solution. Shake for five minutes, filter and wash six times with 2% nitric acid. Place about 10 to 15 grams of mossy zinc in the original flask, place the funnel in the flask and dissolve the yellow precipitate on the paper with two washings of ammonia, (1 to 3) this to be followed with two washings of water. Pour into the flask 150 to 200 c. c. of dilute sulphuric acid and heat gently for 20 Filter through a cotton plug into a titrating jar and wash the flask twice with water, and finally the cotton plug twice Titrate with potassium permanganate of such a with water. strength that 1 c. c. corresponds to .001628% phosphorus, when a 5 gram portion of the ore is taken.

#### SOLUTION.

# Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

# Molybdate.

No. 1 Solution. 3750 c. c. strong nitric acid added to 6000 c. c. water, mix and cool.

No. 2 Solution. 750 grams molybdic acid (Merk's 85%) dissolved in a mixture of 1500 c. c. water and 1500 c. c. strong ammonia. Mix and cool. Add No. 2 Solution slowly, to No. 1 Solution, passing a current of air through the solution to thoroughly mix. Let stand for forty-eight hours before using.

MANGANESE. Three grams of the ore are dissolved by gentle heating, in 75 c. c. of concentrated hydrochloric acid in a 500 c. c. beaker, covered with a watch glass. When the solution is complete add 1 c. c. of nitric acid and 25 c. c. of dilute sulphuric acid, and hasten the evaporation by raising the watch glass slightly. Evaporate to white fumes of sulphuric acid. Cool, and add 150 to 200 c. c. of water, and heat to boiling. Boil five minutes and cool. When cool, transfer the solution to a graduated cylinder, add zinc oxide suspended in water, continuously shaking the solution until there is a slight excess, shown by the yellowish appearance of the precipitate formed. Dilute with water to exactly 600 c. c. in the graduated cylinder, mix the contents thoroughly by shaking, and filter. Of the filtrate take two portions, each 200 c. c., and place in Florence flasks (500 c. c. capacity). Heat to boiling and titrate while boiling, with potassium permanganate. 1 c. c. equals .001473 grams manganese or corresponds to .1473% manganese if one gram portion of the ore is taken.

# SOLUTION.

# Permanganate of Potassium.

122.3 grams dissolved in 43 litres of water.

SILICA. Fuse one gram of ore with five grams of sodium carbonate in a capacious platinum crucible. Cool and dissolve the fusion in an evaporating dish with dilute hydrochloric acid. Cover the dish with a five inch watch glass and evaporate to dryness. Cool, moisten with hydrochloric acid, evaporate and bake. Cool, and add 30 c. c. of dilute hydrochloric acid, heat to boiling. When completely dissolved, filter and wash with hot dilute hydrochloric acid and hot water, alternately, until no iron stain shows. Weigh as silica.

ALUMINA. To the filtrate from the silica, add about 1 c. c. nitric acid and heat to boiling. Add strong ammonia in very slight excess, boil a minute and filter while hot. Wash thoroughly with hot water. Dissolve the precipitate on the paper with hot dilute hydrochloric acid, re-precipitate with ammonia, filter and wash. The filtrates are used for lime determination. The precipitate on the paper is dissolved with boiling hot dilute hydrochloric acid into a 600 c. c. beaker. Add strong ammonia with constant stirring until a deep mahogany color is obtained. If a precipitate is formed add a drop or two of dilute hydrochloric acid, until it is just dissolved, then add ammonia to the proper color. Add 3.3 c. c. of concentrated hydrochloric acid, 10 c. c. of a 10% ammonium phosphate solution, and 30 c. c. of a sodium hyposulphite solution (equivalent to 10 grams of the salt) followed by 5 c. c. of glacial acetic acid. Cover and heat gradually to boiling, with occasional stirring, and boil 15 minutes. Filter with moderate suction and wash eight times with boiling water. Ignite in a weighed porcelain crucible and weigh as aluminum phosphate. The weight times .4185 equals the weight of alumina.

#### SOLUTION.

# Ammonium Phosphate.

100 grams dissolved in 1 litre of water.

LIME. The filtrate from the iron and alumina hydrates is evaporated to 150 or 200 c. c. and 10 c. c. of a saturated solution of ammonium oxalate added while boiling. Add 10 c. c. of strong ammonia and boil 10 minutes. Allow to stand in a warm place for two hours until completely settled, then filter through double papers washing eight times with hot water. Ignite in a weighed platinum crucible, finishing in a blast until the weight is constant. Cool in a dessicator and weigh as lime.

#### SOLUTION.

# Ammonium Oxalate.

50 grams dissolved in 1 litre of water.

MAGNESIA. The filtrate from the calcium oxalate in the lime determination is made slightly acid with hydrochloric acid. Add 10 c. c. of ammonium phosphate solution. Cool and add drop by drop with constant stirring, 25 c. c. of concentrated ammonium hydrate and continue stirring a few minutes. Let stand in a cool place six hours, filter and wash with water containing 10% ammonia and 5% ammonium nitrate. Ignite in a porcelain crucible and weigh as magnesium pyro phosphate. Factor for magnesia is .3624.

#### SOLUTION.

# Ammonium Phosphate.

225 grams dissolved in 1 litre of water.

SULPHUR. Weigh into a 500 c. c. beaker five grams of ore and add 200 to 250 c. c. aqua regia (1 part nitric acid and 9 parts hydrochloric acid). Cover and heat gently until the ore is dissolved. Raise the watch glass on glass hooks and evaporate to dryness. Cool and dissolve in about 15 to 20 c. c. of concentrated hydrochloric acid. Boil, dilute and filter. Wash with a little hot dilute hydrochloric acid and hot water. The solution is diluted to about 400 c. c. with water and heated to boiling. Add 10 c. c. of a 10% barium chloride solution, boil 10 or 15 minutes and evaporate slowly until ferric chloride begins to crystallize out. Dilute to about 400 c. c. with cold water and let stand all night.

The residue of the ore which does not go into solution in the aqua regia is ignited in a platinum crucible and fused with a mixture of sodium carbonate and potassium nitrate, and the fusion dissolved in hot water. Filter, wash with hot water, acidify the filtrate with hydrochloric acid, evaporate to dryness and bake. Dissolve in hot water and add 10 c. c. of dilute hydrochloric acid. Filter and dilute the filtrate to 300 c. c. with water and add 10 c. c. of barium chloride solution. Boil for fifteen minutes, let settle, and filter on the same paper with the main solution which has stood over night. Ignite in a platinum crucible and weigh as barium sulphate. The factor for sulphur is .13732.

#### SOLUTION.

#### Barium Chloride.

100 grams dissolved in 1 litre of water.

# Loss On Ignition.

One gram of the ore is placed in a weighed platinum crucible with a tightly fitting cover and heated to a bright red heat over a Bunsen Burner for fifteen minutes. Cool in a dessicator and weigh. Heat five minutes more and weigh, repeat until the weight remains constant. The loss in weight is the "Loss on Ignition."

# FIGURING PRICE OF ORE FROM ANALYSIS

For many years the value of ores was arrived at, by adding the freight rate to the furnace, to the price quoted per ton at Lake Erie Ports, and dividing this sum by the percentage of natural iron. This gave a base unit value which, multiplied by the percentage of natural iron, gave the selling price of the ore.

In 1908 a new method of figuring the value of ores was

adopted by most of the ore brokers. This method was thought to be fairer to the furnace interests than that used formerly.

The Lake Superior ores are divided into four classes:

Old Range Bessemer Ores, containing 55% Iron Natural, .045% Phosphorus dry.

Old Range Non-Bessemer Ores, containing 51.50% Iron

Natural.

selling prices:

Mesabi Bessemer Ores, containing 55.00% Iron Natural, .045% Phosphorus dry.

Mesabi Non-Bessemer Ores, containing 51.50% Iron Natural. To arrive at the base unit value of any particular ore, add 60 cts. (the average freight rate on ore shipped from Lake Erie Ports) to the quoted selling price and divide by the guaranteed Natural Iron. Doing this, and taking for example, the following

Old Range Bessemer Ores, \$5.00 per ton, called the base price. Old Range Non-Bessemer Ores, \$4.20 per ton, called the base price.

Mesabi Bessemer Ores, \$4.75 per ton, called the base price. Mesabi Non-Bessemer Ores, \$4.00 per ton, called the base price.

The base units are as follows:

Old Range Bessemer	Ores	50.10182
Old Range Non-Besse		
Mesabi Bessemer Ore	s	0.09727
Mesabi Non-Bessemer		

To figure the value of Bessemer Ores, the following tables are used:

For Ores Analyzing Under 55% Iron Natural:

From 55% to 50% Iron Natural, the value of each unit is the base unit. From 50% to 49% Iron Natural, the value is the base unit increased 50%. From 49% to 48% Iron Natural, the value is the base unit increased 100%.

Less than 48% Iron Natural, the value of each unit is 18 cents or whatever figure is named in the ore contract.

For Ores Analyzing Above 55% Iron Natural:

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From 55% to 56% Iron Natural, the value is the base unit increased 1 cent. From 56% to 57% Iron Natural, the value is the base unit increased 2 cents. From 57% to 58% Iron Natural, the value is the base unit increased 3 cents. From 58% to 59% Iron Natural, the value is the base unit increased 4 cents. From 59% to 60% Iron Natural, the value is the base unit increased 5 cents.
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Over 60% Iron Natural, the value of each unit is the base unit value, or whatever figure is named in the Contract.

The Phosphorus adjustment is made according to the Phosphorus table, a copy of which is herewith shown.

Percentage of Phosphorous	Rate of Progression	Phos. Values	Percentage of Phosphorous	Rate of Progression	Phos. Values
.070	.0200	.3500	.037	.0115	.0780
.069	.0195	.3300	.036	.0120	.0900
.068	.0190	.3105	.035	.0125	.1025
.067	.0185	.2915	.034	.0130	.1155
.066	.0180	.2730	.033	.0135	.1290
.065	.0175	.2550	.032	.0140	.1430
.064	.0170	.2375	.031	.0145	.1575
.063	.0165	.2205	.030	.0150	.1725
.062	.0160	.2040	.029	0155	.1880
.061	.0155	.1880	.028	0160	.2040
.060	.0150	.1725	.027	.0165	.2205
.059	.0145	.1575	.026	.0175	.2550
.058	.0140	.1430	.025	.0175	.2550
.057	.0135	.1290	.024	.0180	.2730
.056	.0130	.1155	.023	.0185	.2915
.055	.0125	.1025	.022	.0190	.3105
.054	.0120	.0900	.021	.0195	.3300
.053	.0115	.0780	.020	.0200°	.3500
.052	.0110	.0665	.019	.0205	.3705
.051	.0105	.0555	.018	.0210	.3915
. <b>0</b> 50	.0100	.0450	.017	.0215	.4130
.049	.0095	.0350	.016	.0220	.4350
.048	.0090	.0255	.015	.0225	.4575
.047	.0085	.0165	.014	.0230	.4805
.046	.0080	.0080	.013	. <b>0</b> 235	.5040
.045	.0000	.0000	.012	.0240	.5280
.044	.0080	.0080	.011	.0245	.5525
.043	.0085	.0165	.010	.0250	.5775
.042	.0090	.0255	.009	.0255	.6030
.041	.0095	.0350	.008	.0260	.6290
.040	.0100	.0450	.007	.0265	.6555
.039	.0105	.0555	.006	.0270	.6825
.038	.0110	.0665	.005	.0275	.7100

To figure the value of Non-Bessemer ores the following tables are used:

For Ores Analyzing under 53% Iron, Natural:

From 53% to 50% Iron Natural, the value is the base unit. From 50% to 49% Iron Natural, the value is the base unit increased 50%. From 49% to 48% Iron Natural, the value is the base unit increased 100%.

Less than 48% Iron Natural, the value of each unit is 18 cents, or whatever figure is named in the ore contract.

For Ores Analyzing Over 53% Iron, Natural:

From 53% to 54% Iron Natural, the value is the base unit increased 1 cent. From 54% to 55% Iron Natural, the value is the base unit increased 2 cents. From 55% to 56% Iron Natural, the value is the base unit increased 3 cents. From 56% to 57% Iron Natural, the value is the base unit increased 4 cents. From 57% to 58% Iron Natural, the value is the base unit increased 5 cents.

Over 58% Iron Natural, the value of each unit is the base unit value.

These calculations may be illustrated as follows:

Suppose the analysis of an Old Range Bessemer ore is 48.00% Iron Natural and .045% Phosphorus dried at 212° F. and that the base Old Range Bessemer ore which is guaranteed 55% Iron Natural and .045% Phosphorus dried at 212° F. selling for \$5.00 per ton delivered to Lake Erie Ports. The actual selling price would be calculated as follows:

55% to 50% 50% to 49% 49% to 48%	equals 1	unit. 1	times	the b	ase u	nit plus	50%	equals	. <b></b> .	.15272
	for Iron for Phos									
	al Penalt 1 cts. per			• • • • •		· · · · · · · · ·			\$	5.91044

This penalty subtracted from the base price, namely, \$5.00 gives \$4.09 as the value of the ore.

Suppose the analysis of a Mesabi Bessemer ore is 59.50% Iron Natural and .045% Phosphorus dried at 212° F. and that the base Mesabi Bessemer ore which is guaranteed at 55% Iron Natural and .045% Phosphorus dried at 212° F. is selling at \$4.75 per ton. The actual selling price would be calculated as follows:

From 55% to From 56% to From 57% to From 58% to From 59% to	56% equals 1 unit. 1 times base unit plus 1c equals\$.10727 57% equals 1 unit. 1 times base unit plus 2c equals11727 58% equals 1 unit. 1 times base unit plus 3c equals12727 59% equals 1 unit. 1 times base unit plus 3c equals13727 59.50% equals ½ unit. ½ times base unit plus 5c equals07364
	for Iron
Total	Premium

This premium of 58 cts. added to the base price, namely, \$4.75 gives \$5.33 as the value of the ore.

Suppose the analysis of an Old Range Non-Bessemer ore is 48% Iron Natural and that the base Old Range Non-Bessemer ore which is guaranteed 51.50% Iron Natural is selling for \$4.20 per ton delivered to Lake Erie Ports. The actual selling price would be calculated as follows:

50.00% to 49% equals 1 unit.	1.5 times base unit equals
Total Penalty	

This penalty subtracted from the base price, namely, \$4.00, gives \$3.55 as the value of the ore.

Suppose the analysis of a Mesabi Non-Bessemer ore is 55% Iron Natural and that the base Mesabi Non-Bessemer ore which is guaranteed at 51.50% Iron Natural is selling for \$4.00 per ton delivered at Lake Erie Ports. The actual selling price would be calculated as follows:

From 53 %	to 54% =	= 1´ unit	. 1 time	s base unit p	= \$.13398 lus 50% = .13398 us 100% = .17864
Premium	for Tron				\$ 44660

This premium of 45 cts. added to the base price, namely, \$4.00, gives \$4.45 as the value of the ore.

In a manganiferous ore, the manganese is generally calculated as a metal with the iron, that is, the total percentage of iron and manganese in the natural, are used as a percentage of iron in calculating the value of the ore.

Silicious ores, that is, ores showing 20% or more silica, are generally sold for a special price.

# VALUE OF IRON ORES

The first iron ore sold at Lower Lake Ports was in 1855 and the price was \$10.00 per ton at the Lower Lake Ports. The next year the price dropped to \$8.00 per ton, for both Bessemer and Non-Bessemer.

From 1856 till 1872, the price of Bessemer and Non-Bessemer ore was practically the same, but this price fluctuated between the low figure of \$5.25 per ton in 1860 to the high figure of \$10.50 per ton in 1867.

From 1872 to date the price of Bessemer ore has been higher than that of Non Bessemer ore. The difference has varied from \$3.00 per ton in 1873 to the present 1910 prices, at which time there is a difference of 80 cts. per ton between the Old Range Bessemer and the Non-Bessemer, and a difference of 75 cts. per ton between the Mesabi Bessemer and the Non-Bessemer ores.

# Prices of Iron Ore at Lower Lake Ports for Each Range Since Opening

YEAR	5	_						SABI
	Веяешег	Non- Bessener	Bessemer	Non- Bessemer	Веменег	Non- Bessemer	Bessemer	Non- Bessemer
1855	\$10.00	\$10.00						
1856	8.00	8.00						
1857	8.00	8.00						
1858 1859	6.50 6.00	6.50 6.00						
1860	5.25	5.50						
1861	5.25	5.00						
1862	5.25	5.37						
1863	7.50	7.50						
1864	8.50	8.50						
1865 1866	7.50 9.50	7.50 9.50 to 14.0	nni					
1867	10.50	8.00 to 11.						
1868	8.25	8.25						
1869	8.25	9.50	_					
1870	8.50	8.50 to 9.50	0					
1871	8.00	8.00						
1872 1873	9.00 12.00	7.50 9.00						
1874	9.00	7.00						
1875	7.00	5.50						
1876	6.75	4.50						
1877	6.50	4.25						
1878	5.50	4.25						
1879	6.25 9.25	4.75 8.00						
1880 1881	9.00	7.00						
1882	9.00	6.25						
1883	6.25	5.00	\$6.00	\$4.75				
1884	5.76	4.50	5.25	4.50	\$4.75	\$4.50		
1885	5.50	4.25	4.75	4.00	5.00	4.00		
1886	5.50 7.25	4.75 5.25	5.25 6.00	4.50 5.00	5.75 6.75	4.50 5.00		
1887 1888	5.50	4.75	4.75	4.00	5.75	4.00		
1889	5.50	4.50	4.50	4.50	5.50	4.50		
1890	6.75	5.75	5.50	5.25	6.50	5.50		
1891	6.00	4.75	4.50	4.25	5.50	4.00		
1892	5.50	4.85	4.50	3.65	5.65	4.85	<b>#2 00</b>	
1893 1894	4.25 2.75	3.00 to 3.50 2.15	0 3.85 2.75	3.20 2.50	4.50 3.35	4.00 3.00	\$3.00 2.35	•
	75 to 3.50	2.15 to 2.30	2.90	2.25	3.40	3.00	2.15	\$1.90
1896	4.00	2.45 to 2.8		2.70	3.50	2.25	3.50	2.25
1897	2.65	2.00 to 2.6		2.15	2.25	1.90	2.25	1.90
1898 3.1	10 to 3.35	2.35 to 2.4		1.85	2.25	1.75	2.25	1.75
	21 to 3.50	2.50	3.00	2.15	2.40	2.00	2.40	2.00
	93 to 6.48 66 to 4.92	5.00 3.65 to 3.8	5.50 5 4.25	4.25 3.00	4.50 3.25	4.00 2.75	4.50 3.25	4.00 2.75
1902 4.0	65 to 5.00	3.80 to 4.0		3.25	3.25	2.75	3.25	2.75
	85 to 5.15	4.00 to 4.2	5 4.50	3.60	4.00	3.20	4.00	3.20
1904 3.0	60 to 3.85	3.10 to 3.3	5 3.25	2.75	3.00	2.50	3.00	2.50
1905	3.75	3.20	3.75	3.20	3.50	3.00	3.50	3.00
1906	4.25	3.70	4.25	3.70	4.00	3.50	4.00	3.50
1907 1908	5.00 4.50	4.20 3.70	5.00 5.00	4.20 4.20	4.75 4.75	4.00 4.00	4.75 4.75	4.00 4.00
1909	4.50	3.70 3.70	4.50	3.70	4.50	3.70	4.75	3.50
1910	5.00	4.20	5.00	4.20	5.00	4.20	4.75	4.00

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190/	20	5.00	4.20	4./3	4.00	4./3	4.00
1908	70	5.00	4.20	4.75	4.00	4.75	4.00
1909	70	4.50	3.70	4.50	3.70	4.25	3.50
1910	20	5.00	4.20	5.00	4.20	4.75	4.00

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# LOCATION and DESCRIPTION of MINES

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# MARQUETTE RANGE

# AMERICAN MINE.

Location: Marquette County, Michigan, Section 32, Township 48, Range 28.

Description: Re-opened in 1906. Two ores are shipped from this mine, AMERICAN, a hard, silver gray, 1st grade Bessemer Specular; and ALLIANCE, a hard, silver gray, 2nd grade Bessemer Specular. Ore is crushed.

The mine is worked by underground stoping system. Greatest

vertical depth 850 feet.

The ore is shipped via the D., S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there to the lower lake ports by boat.

The mine is operated by the American-Boston Mining Co.

Some ore shipped prior to 1893 from Sterling mine.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1880	797	tons	1890— 21,000 tons
1881—	4,702	tons	1891— 21,604 tons
1882	8,006	tons	1892— 15,076 tons
1883	3,618	tons	1893 to 1905—
1884	2,916	tons	1906— 419 tons
1885		• ,	1907— 13,764 tons
1886—			1908— 23,222 tons
1887—	1,483	tons	1909— 90,001 tons
1888			1910—163,290 tons
1889	20.032	tons	

Total, Tons ......403,629

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

American:

Lime Magnes. Iron Phos. Mang. Silica Alum. Sulph. Loss 57.60 .040 12.34 .04 3.44 .31 .011 1.10 Alliance:

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron .039 17.54 53.18 .03 4.14 .25 .48 .022 1.07

The Ore in its natural state is as follows:

American:

Moist Iron Phos. Silica 2.05 56.42 .039 12.09

Alliance:

Moist Iron Phos. Silica 1.71 52.27 .038 17.24

# ANGELINE MINE.

Location: Marquette County, Michigan, Section 15, Township 47 North, Range 27 West. It is in the city of Ishpeming.

Description: First opened up in 1864. Two ores are shipped from this mine. ANGELINE HEMATITE, a soft, red, Bessemer Hematite; SOUTH ANGELINE HEMATITE, a soft, red, Non-Bessemer Hematite.

It is an underground mine worked by slicing system. Greatest vertical depth 515 feet.

The mine is operated by Pittsburgh & Lake Angeline Iron

The ore is shipped via. the L. S. & I., D. S. & A., C. & N. W. Railways to L. S. & I. docks, Marquette, and from there to the lower lake ports.

# Yearly Shipments:

1888—223,600 tons
1889—229,070 tons
1890—261,681 tons
1891—241,605 tons
1892—287,517 tons
1893—351,973 tons
1894—355,453 tons
1895—313,555 tons
1896—342,251 tons
1897—489,685 tons
1898—460,333 tons
1899—464,988 tons
1900—389,128 tons
1901—481,574 tons
1902—304,125 tons
1903—310,950 tons
1904—262,486 tons
1905—374,183 tons
1906—269,116 tons
1907—283,373 tons
1908—220,410 tons
1909—280,298 tons
1910—244,923 tons
,

Total, Tons ......8,530,383.

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Angeline Hematite:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 65.30 .041 3.79

South Angeline Hematite:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 63.95 .128 4.40

The Ore in its natural state is as follows:

Angeline Hematite:

Moist Iron Phos. Silica 9.32 59.21 .037 3.43

# South Angeline Hematite:

Moist Iron Phos. Silica 10.08 57.50 .115 3.95

#### AUSTIN MINE.

Location: Marquette County, Michigan, Section 20, Township 45. Range 25.

**Description:** First opened up in 1903. Ore is a soft, Non-Bessemer Hematite.

Mine is worked by the caving system. Greatest vertical depth 318 feet.

The ore is shipped via the Munising and C. & N. W. Railways to Presque Isle and Escanaba.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 60.80
 .086
 8.95
 .52
 .71
 .88
 .28
 .012
 .95

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.00 52.29 .074 7.70

# BESSIE MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 29.

Description: First opened up in 1890. Ore is a soft, brown, Non-Bessemer Hematite and Limonite.

Mine is shut down at present. Greatest vertical depth 200 feet

The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there by boat to the lower lake ports.

Sales Agents: John M. Longyear, Marquette, Mich.

Yearly Shipments:

## BREITUNG HEMATITE NO. 1.

Location: Marquette County, Michigan, N. W. 1/4, S. W. 1/4 of Section 8. Township 47 North, Range 26 West.

Description: First opened up in 1901. Four ores are shipped from this mine, FOLEY and FOLEY NO. 2, soft, red and blue, low phosphorous Bessemer Hematites; BREITUNG SILICIOUS, and HEMATITE SILICIOUS, semi-hard, red and blue Bessemer Silicious Hematites.

The mine is worked by the caving system. Greatest vertical

depth 367 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

The mine was shut down from 1903 to 1909. Reopened in

1909.

Sales Agents: E. N. Breitung & Co., Cleveland.

**Yearly Shipments** for Breitung Hematite Nos. 1 and 2.

1907- 59,667 tons 1903— 7,854 tons 1904--- 9,869 tons 1908— 55,849 tons 1909-129,673 tons 1905-1906— 38,671 tons 1910-114,202 tons Total, Tons ......415,785

The average of all cargo analysis for 1910 is as fol-Analysis:

Dried at 212° F. lows:

Foley: Alum. Silica Lime Sulph. Loss Iron Phos. Mang. Magnes. 63.27 .017 1.45 .010 1.50 6.43 .08 .18 .18

Foley No. 2: Phos. Silica Iron

Alum. Mang. Lime Magnes. Sulph. Loss 54.88 17.85 1.50 .018 .08 1.70 .22 .11 .010

**Breitung Silicious:** 

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss .018 33.94 .21 1.93 1.21 trace .027 .79 43.20

Hematite Silicious:

Silica Alum. Lime Magnes. Sulph. Loss Iron Phos. Mang. 34.00 .12 43.00 .84 2.24 1.68 .008 1.58 .033 The Ore in its natural state is as follows:

Foley:

Moist Iron Phos. Silica 7.74 58.37 .016 5.93

Foley No. 2:

Phos. Moist Iron Silica 50.45 8.06 .017 16.41

Breitung Silicious:

Moist Iron Phos. 6.46 40.41 .017 31.75

Hematite Silicious:

Silica Moist Iron Phos. 40.42 .031 31.96 6.00

# BREITUNG HEMATITE NO. 2.

Location: Marquette County, Michigan, S. E. 1/4, N. W. 1/4 of Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1902. Two ores shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

The mine is worked by the caving system. Greatest vertical

depth 369 feet,

The ore is shipped via the D. S. S. & A. and C. &. N. W Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co., Cleveland.

For Shipments see Breitung No. 1.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mary:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss **58.73** .103 8.35 2.59 .23 2.98 .62 .63 .026

Charlotte:

Phos. Silica Alum. Lime Magnes. Sulph. Iron Mang. Loss 54.35 14.60 .090 .45 2.85 .81 1.40 .022 1.96

The Ore in its natural state is as follows:

Mary:

Moist Iron Phos. Silica 13.47 50.82 .089 7.23

Charlotte:

Moist Iron Phos. Silica 11.56 48.07 .080 12.91

## CAMBRIA MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 27.

Description; First opened up in 1875. The ore is a hard, brown, Non-Bessemer Hematite.

It is operated as a stoping and subing mine. Greatest vertical depth 883 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there by boat to the lower lake ports.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna Co., Cleveland.

Yearly Shipments:

1875— 2,610 tons 1877— 10,085 tons 1876— 6,329 tons 1878— 3,754 tons

```
1879— 6,724 tons
                                           1895— 41,656 tons
        6,958 tons
                                           1896-- 95,086 tons
1880---
                                           1897—110,648 tons
1898—102,623 tons
1899—124,930 tons
1881— 19,246 tons
1882— 64,545 tons
1883— 47,508 tons
1884— 59,742 tons
                                           1900— 80,432 tons
      - 50,796 tons
                                           1901-68,907 tons
1885
1886-
      - 58,784 tons
                                           1902— 63,976 tons
1887-41,136 tons
                                           1903-41,168 tons
1888— 57,865 tons
1889— 72,780 tons
                                           1904— 84,852 tons
                                           1905— 81,791 tons
1890- 80,359 tons
                                           1906— 40,628 tons
1891- 34,662 tons
                                           1907—135,145 tons
                                           1908— 85,977 tons
1892— 41,549 tons
1893- 30,445 tons
                                           1909—136,815 tons
1894-47,218 tons
                                           1910-150,422 tons
                   Total, Tons .....2,188,149
```

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.90 .093 9.82 .24 2.64 .76 .48 .013 3.17

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.98 51.54 .083 8.74

# CHAMPION MINE.

Location: Marquette County, Michigan, Sections 31 and 32, Township 48. Range 29.

Description: First opened up in 1867. Ore is No. 1 Lump, a hard, blue, Non-Bessemer Hematite.

It is an underground mine. Greatest vertical depth, 2,292 feet.

The ore is shipped via the C. & N. W. and C. M. & St. P. Railways to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

# Yearly Shipments:

1867— 500	tons	1880—112,401	
1868— 6,225	tons	1881—145,427	
1869— 19,458	tons	1882—159,009	
1870— 73,161	tons	1883—104,960	
1871— 41,625	tons	1884—210,180	
1872— 68,405	tons	1885—173,915	
1873— 72,782	tons	1886—137,593	
1874 46,769	tons	1887—146,330	
1875— 57,979	tons	1888—174,680	
1876— 66,002	tons	1889—215,098	
1877— 70,883	tons	1890—223,442	
1878— 73,464	tons	1891—133,413	
1879— 94.027	tons ·	1892—109,979	tons

```
    1893—61,648 tons
    1902—205,721 tons

    1894—42,788 tons
    1903—74,238 tons

    1895—100,398 tons
    1904—174 tons

    1896—113,375 tons
    1905—64,680 tons

    1897—141,728 tons
    1906—145,007 tons

    1898—163,190 tons
    1907—107,577 tons

    1899—215,074 tons
    1908—313 tons

    1900—113,743 tons
    1909—11,199 tons

    1901—69,026 tons
    1910—18,746 tons
```

Total, Tons ......4,413,331

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 61.90 .078 5.15

The Ore in its natural state is as follows:

Moist Iron Phos. Silica .88 61.35 .077 5.11

#### CLIFF SHAFT MINE.

Location: Marquette County, Michigan, Sections 9 and 10, Township 47, Range 27.

**Description:** First opened up in 1887. Two ores are shipped from this mine, CRUSHED CLIFF SHAFT and LUMP CLIFF SHAFT, both hard, red, Non-Bessemer, Specular. The ore is crushed and screened.

It is worked as an open, over hand, stoping mine. The pillars are left. Greatest vertical depth 736 feet.

The ore is shipped via the L. S. & I., C. & N. W., and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

ompinents.	
Cliff Shaft.	
1887— 87,346 tons	1892—289,395 tons
1888— 78,520 tons	1893—130,812 tons
1889—134,616 tons	1894—253,760 tons
1890—188,776 tons	1895—259,042 tons
1891—278,270 tons	
Cleveland Cliffs Gro	up.
Prior to 1888—3,704,954 tons	1900— 881,021 tons
1888— 184,316 tons	1901— 860,484 tons
1889— 274,048 tons	1902—1,104,864 tons
1890— 331,713 tons	1903— 810,845 tons
1891— 221,788 tons	1904— 743,263 tons
1892— 310,907 tons	1905—1,288,416 tons
1893— 348,917 tons	1906—1,330,944 tons
1894— 797,466 tons	1907—1,030,928 tons
1895— 480,195 tons	1908— 438,379 tons
1896— 513,119 tons	1909— 877,433 tons
1897— 718,408 tons	1910— 955,374 tons
1898— 869,482 tons	Total, Tons22,405,270
1899—1,011,048 tons	

Cleveland Cliffs Iron Co. Prior to 1894 143,706 tons 1887—3,497,513 tons 1887— 207,441 tons 1888— 184,316 tons 1895-221,153 tons 1896-513,119 tons 1897 -718,408 tons 1889-274,048 tons 1898-869,482 tons 1890-1899-1,011,048 tons 331,713 tons 1891-- 221,788 tons 1900— 881,021 tons 1892— 310,907 tons 1901— 860,484 tons 1893— 218,105 tons 1902-1,104,864 tons Total, Tons ......11,569,116

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

#### Crushed Cliff Shaft:

Phos. Silica Mang. Alum. Sulph. Iron Lime Magnes. Loss 59.20 .112 6.42 .51 2.74 1.87 .82 .014 1.92

# Lump Cliff Shaft:

Phos. Sulph. Silica Alum. Lime Iron Mang. Magnes. Loss 59.70 .103 4.90 .79 2.75 2.46 1.75 1.12 .016

The Ore in its natural state is as follows:

#### Crushed Cliff Shaft:

Moist Iron Phos. Silica 1.00 58.61 .111 6.36

# Lump Cliff Shaft:

Moist Iron Phos. Silica .50 59.40 .102 4.88

# EMPIRE MINE.

Location: Marquette County, Michigan, Section 19, Township 47, Range 26.

Description: First opened up in 1907. Ore is a hard, red, silicious Hematite. Ore is crushed to two inch size.

It is an open pit milling mine. Greatest vertical depth 200 feet.

The ore is shipped via the C. & N. W. Railway to Escanaba, Mich., and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

# Yearly Shipments:

1907— 40,565 tons 1909—108,993 tons 1908— 53,537 tons 1910— 53,687 tons Total, Tons ......256,782

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Phos. Iron Silica Mang. Alum. Lime Magnes. Sulph. Loss 40.23 .074 40.60 .08 1.02 .49 .24 .025 1.10

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 3.03 39.01 .072 39.37

#### HARTFORD MINE.

Location: Marquette County, Michigan, Section 36, Township 48, Range 27.

Description: First opened up in 1889. There are two ores shipped from this mine, BERNHART and AVERHART, hard, brown, Non-Bessemer Hématites.

The mine is worked by the stoping system. Greatest vertical

depth 1,075 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there by boat to the lower lake ports.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

# Yearly Shipments:

1889	566	tons	1901—
1890			1902— 7,440 tons
1891—			1903— 20,085 tons
1892—			1904—179,980 tons
1893—	6,513	tons	1905—322,209 tons
1894—			1906—364,801 tons
1896	1,532	tons	1907—328,161 tons
1897—			1908—278,366 tons
1898—			1909—250,680 tons
1899—			1910—183,471 tons
1900			

Total, Tons ......1,950,422

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

#### Bernhart:

Iron 50 14		Mang.	Alum.	Lime	Magnes.	Sulph.	Loss

#### Averhart:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
59.52	.059	8.04				_	_	

The Ore in its natural state is as follows:

#### Bernhart:

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Moist Iron Phos. Silica
10.00 50.53 .066 10.78
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#### Averhart:

Moist Iron Phos. Silica 10.07 53.52 .053 7.23

# HIMROD MINE.

Location: Marquette County, Michigan, Section 7, Township 47 North, Range 26 West.

Description: First opened up in 1873. The ore is hard, red, silicious Hematite. It is worked as an open pit mine. The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there to the lower lake ports by boat.

Sales Agents: E. N. Breitung & Co., Cleveland.

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 41.75
 .054
 36.20
 .03
 1.28
 .38
 .05
 .005
 1.50

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 4.00 40.08 .052 34.75

#### IMPERIAL MINE.

Location: Baraga County, Michigan, Section 25, Township 48, Range 31.

Description: First opened up in 1882. The ore is a soft, yellow, Non-Bessemer Limonite.

The mine is worked by the open stoping and caving system. Greatest vertical depth 186 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette, Mich., and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1890— 38,460 tons 1891— 18,552 tons 1901-1902-1892---7,194 tons 1903-1904 1893 727 tons 1894 1905 1,661 tons 5,076 tons 1895 1906-1907— 55,756 tons 1908— 48,231 tons 1896 1897-1909-115,478 tons 1898-1899- 23,235 tons 1910— 83,404 tons 1900— 62,321 tons Total, 1 ons .......460,095

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron 2.98 2.12 .021 8.63 51.40 .302 11.15 .180 .64

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.70 45.39 .267 9.85

# JACKSON MINE.

Location: Marquette County, Michigan, Section 1, Township 47, Range 27.

Description: First opened up in 1846. Two ores are shipped from this mine, JACKSON BESSEMER and SOUTH JACKSON, both hard, red, silicious and manganiferous Specular. The ore is crushed. It is worked as an open pit mine:

The ore is shipped via the L. S. & I., C. & N. W., and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

Simplification.	
Prior to 1857—28,463 tons	1884— 83,251 tons
1857— 12,442 tons	1885— 68,657 tons
1858— 10,309 tons	1886 89,370 tons
1859— 28,377 tons	1887—109,606 tons
1860— 41,295 tons	1888—101,909 tons
1861— 12,919 tons	1889—128,891 tons
1862— 46,096 tons	1890—124,682 tons
1863— 77,237 tons	1891— 92,979 tons
1864— 83.905 tons	1892— 92,567 tons
1865— 65,505 tons	1893— 51,009 tons.
1866— 92,287 tons	1894— 32,298 tons
1867—127,491 tons	1895— 42,186 tons
1868—130,524 tons	1896— 80,710 tons
1869—125,908 tons	1897— 79,102 tons
1870—127,642 tons	1898— 55,012 tons
1871—138,297 tons	1899— 88,230 tons
1872—119,910 tons	1900— 31,714 tons
1873—130,131 tons	1901— 38,271 tons
1874— 94,708 tons	1902— 15,449 tons
1875— 87,283 tons	1903— 5,409 tons
1876— 98,480 tons	1904—
1877— 80,340 tons	1905— 33,180 tons
1878— 83,121 tors	1906— 5,066 tons
1879— 12,921 tons	1907— 61,345 tons
1880—120,622 tons	1908—
1881—118,939 tons	1909— 11,060 tons
	1010 40 220 tons
1882— 96,830 tons	1910— 40,320 tons
1883— 71,278 tons	

Total, Tons ......3,925,533

**Analysis:** Expected analysis for season of 1911 is as follows: Dried at 212° F.

# Jackson Bessemer:

Iron	Phos042	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
50.30		24.50	.10	2.00	.35	.08	.015	1.00
South Ja	ckson:							
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
41.70	.086	31.50	2.60	1.51	.34	.27	.022	2.48

The Ore in its natural state is as follows:

# Jackson Bessemer:

Moist Iron Phos. Silica 2.00 49.29 .041 24.01

# South Jackson:

Moist Iron Phos. Silica 7.25 38.68 .080 29.22

# LAKE MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1888. There are two ores shipped from this mine, LAKE, a soft, Non-Bessemer Hematite; and LAKE BESSEMER, a soft Bessemer Hematite. It is worked by the caving system. Greatest vertical depth 555 feet.

The ore is shipped via the L. S. & I., C. & N. W. and D. S. S. & A. Railways to Presque Isle and Escanaba and from there to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

1892—188,439	tons			1901—406,783	tons
1893—162,700	tons			1902—448,427	tons
1894— 94,715	tons			1903—456,514	tons
1895—160,790	tons			1904—399,621	tons
1896—162,326	tons			1905—568,568	tons
1897—339,521	tons			1906—600,002	tons
1898—386,088	tons			1907—552,530	tons
1899—464,549	tons			1908250,252	tons
1900—457,453	tons			1909—463,478	tons
•				1910—244,923	tons
		Total,	Tons	6,807,679	

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

#### Lake:

Mang. Phos. Silica Lime Iron Alum. Magnes. Sulph. Loss 58.70 .70 .108 6.68 2.68 .65 .98 .015 3.75

#### Lake Bessemer:

Mang. Iron Phos. Silica Alum. Lime Magnes. Sulph. Loss 60.00 .048 9.73 .54 1.27 .66 .30 .011 1.45

The Ore in its natural state is as follows:

#### Lake

Moist Iron Phos. Silica 13.00 51.07 .094 5.81

#### Lake Bessemer:

Moist Iron Phos. Silica 13.30 51.02 .042 8.44

# LAKE SUPERIOR (Hard) MINE.

Location: Marquette County, Michigan, Sections 9 and 10, Township 47, Range 27.

Description: First opened up in 1857. Eight grades of ore are shipped from this mine, ABBOTSFORD, a hard, blue, Bessemer Hematite; BERESFORD LUMP, hard, steel blue, Non-Bessemer Hematite; BERESFORD CRUSHED, a hard, steel blue, Non-Bessemer Hematite; CASTLEGUARD, a hard, blue, Bessemer, Silicious Hematite; CASTLEFORD, a hard, dark gray, Non-Bessemer, Silicious Hematite; HEMATITE, a hard, dark red, Non-Bessemer Hematite; HIGH GRADE HEMATITE, a hard, dark red, Non-Bessemer Hematite; and CHATFORD, a hard, Non-Bessemer, Silicious Hematite. The Beresford ore is crushed. It is an underground mine. Greatest vertical depth 1,070 feet. The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

This mine is operated by the Oliver Iron Mining Co.

# Yearly Shipments:

	Lake Superio	or	1884—204,796	tons
	1857—		1885-226,040	tons
	1858— 4,658	tons	1886—267,622	tons
	1859— 24,668	tons	1887—302,909	tons
	1860— 33,015	tons	1888—240,225	tons
	1861— 25,195	tons	1889—288,784	
	1862— 37,709	tons	1890—318,321	tons
	1863— 78,976	tons	1891—308,831	
	1864— 86,773	tons	1892—366,715	tons
	1865— 55,201	tons	1893—329,610	tons
	1866— 68,002	tons	1894—344,758	
	1867—119,935		1895—342,439	tons
	1868—105,745	tons	1896—459,576	tons
	1869—135,560	tons	1897—376,761	tons
	1870—166,582		1898—686,563	tons
	1871—158,047	tons	1899682,595	tons
	1872—195,617		1900—709,143	
	1873—158,428		1901635,642	
	1874—124,311		1902—832,796	
	1875—129,365		1903—604,829	
	1876—110,570		1904—590,339	
	1877—127,349		1905—727,378	tons
٠	1878—109,674		1906—635,671	tons
	1879—174,747		1907—674,066	tons
	1880—204,094		1908—261,955	
	1881—262,235		1909—349,435	
	1882—296,509		1910—271,445	tons
	1883—200,799	tons		

Total, Tons .....15,233,008

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Loss

Loss

Loss

Loss

Loss

3.81

13.78

51.91

52.08

High Grade Hematite:

Moist Iron

.082

Phos.

.070

15.88

Silica

7.23

Abbotsford: Phos. Iron Silica Mang. Alum. Lime Magnes. Sulph. 62.13.033 6.30 Beresford Lump: Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. 62.58 .110 5.40 Castleguard: Iron Phos. Lime Magnes. Silica Mang. Alum. Sulph. 53.01 .045 20.87 Castleford: Phos. Iron Silica Mang. Alum. Lime Magnes. Sulph. 53.97 .086 16.51 High Grade Hematite: Phos. Iron Silica Mang. Alum. Lime Magnes. Sulph. 60.40 .082 8.39 The Ore in its natural state is as follows: Abbotsford: Moist Iron Phos. Silica 3.78 **59.78** .032 7.98 Beresford Lump: Moist Iron Phos. Silica .108 1.59 61.59 5.32 Castleguard: Phos. Moist Iron Silica 4.48 50.63 .043 19.94 Castleford: Moist Iron Phos. Silica

# LAKE SUPERIOR (Soft) MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1857. Four grades of ore are shipped from this mine, ALFORD, a soft, reddish blue, Bessemer Hematite; BEDFORD, a soft, dark red, Non-Bessemer Hematite; BEDFORD HIGH SILICIOUS, a soft, dark red, Non-Bessemer Silicious Hematite; and ABBOTS-FORD, a soft, blue, Bessemer Hematite.

It is an underground mine. Greatest vertical depth 1,102 feet. The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba and from there to the lower lake ports by boat.

The mine is operated by the Oliver Iron Mining Co.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alford:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 62.89 .028 6.69

Bedford:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 55.11 .073 13.63

The Ore in its natural state is as follows:

Alford:

Moist Iron Phos. Silica 9.87 56.68 .025 6.03

Bedford:

Moist Iron Phos. Silica 9.98 49.61 .066 12.27

#### LILLIE MINE.

Location: Marquette County, Michigan, Section 35, Township 48, Range 27.

**Description:** First opened up in 1875. The ore is a hard, brown, Non-Bessemer Hematite.

The mine is worked by stoping system. Greatest vertical depth 1,000 feet.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there to the lower lake ports by boat.

The mine is operated by the Republic Iron & Steel Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1875— 144			1893— 68,861	tons
1876— 5,801	tons		1894— 78,388	tons
1877— 10,127	tons		1895— 54,285	tons
1878— 8,506	tons		1896—107,532	tons
1879— 22,380	tons		1897—112,781	tons
1880— 18,347	tons		1898—211,023	tons
1881— 16,748	tons		1899—196,200	tons
1882— 27,494	tons		1900—114,990	tons
1883— 4,614	tons		1901— 98,788	tons
1884— 2,683	tons		1902— 79,919	tons
1885— 708	tons		1903— 77,454	tons
1886 3,957	tons		1904— 63,209	tons
1887— 23,041	tons		1905— 9,868	tons
1888— 32,692	tons		1906— 32,781	tons
1889— 33,916	tons		1907— 80,545	tons
1890— 31,812	tons		1908— 8,632	tons
1891— 19,551	tons		1909— 61,708	tons
1892— 29,005	tons		1910— 10,121	tons
	Total,	Tons	1,758,611	

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Mang. Iron Phos. Silica Alum. Lime Magnes. Sulph. Loss 9.20 58.21 .090 .26 2.56 .78 .40 .016 3.47

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.99 51.23 .079 8.10

# LUCY MINE.

Location: Marquette County, Michigan, Section 6 and 7, Township 47, Range 26.

Description: First opened up in 1878. The ore is a silicious and manganiferous soft Hematite.

It is worked by the open stoping and caving system. Greatest vertical depth is 281 feet.

The ore is shipped via the L. S. & I., C. & N. W., D. S. S. & A. Railways to Presque Isle and Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Dilipincino.	
1878— 30,180 tons	1895—
1879— 28,962 tons	1896
1880— 31,206 tons	1897— 10,033 tons
1881— 28,051 tons	1898— 11,846 tons
1882— 40,406 tons	1899—
1883— 14,676 tons	1900
1884—	1901
1885—	1902—
1886—	1903—
1887— 12,139 tons	1904
1888— 22,276 tons	1905—
1889— 32,982 tons	1906— 85 tons
1890— 43,483 tons	190 <b>7</b>
1891— 27,683 tons	1908— 1,115 tons
1892— 26,326 tons	1909— 1,672 tons
1893— 21,964 tons	1910— 11,257 tons
1894—	

Total, Tons ......530,288

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica • Mang.
 Alum.
 Lime Magnes.
 Sulph.
 Loss 2.00

 45.90
 .063
 23.80
 3.30
 2.72
 .22
 .14
 .025
 2.00

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.50 41.08 .056 21.30

# MAAS MINE.

Location: Marquette County, Michigan, Section 31, Township 48, Range 26.

**Description:** First opened up in 1902. Ore is a soft, Non-Bessemer Hematite.

The mine is worked by the caving system. Greatest vertical depth 1,100 feet.

The ore is shipped via the L. S. & I. Railway to Presque Isle and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

1907— 32,378 tons 1908— 29,036 tons 1910—208,103 tons

Total, Tons ......428,714

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 58.80
 .089
 8.50
 .25
 2.56
 1.23
 .27
 .018
 2.60

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.50 52.04 .079 7.52

# MAITLAND SHAFT MINE.

Location: Marquette County, Michigan, Section W. ½ of N. W. ¼, Section 30, Township 47 West, Range 26.

Description: First opened up in 1910. Ore is soft, blue, Bessemer, Non-Bessemer and Silicious Hematite.

The mine is in an early stage of development. Greatest vertical depth at present, 300 feet.

No ore has been shipped.

# MARY CHARLOTTE NO. 1 MINE.

Location: Marquette County, Michigan, N. E. 1/4, S. W. 1/4, Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1903. Two ores are shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

It is worked by the caving system. Greatest vertical depth 365 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba, and from there to the lower lake ports by boat.

Sales Agents: E. N. Breitung & Co., Cleveland.

# Yearly Shipments:

 1903— 34,303 tons
 1907—155,633 tons

 1904— 48,885 tons
 1908— 99,104 tons

 1905—221,738 tons
 1909—240,433 tons

 1906—257,088 tons
 1910—197,522 tons

 Total, Tons
 ......1,254,706

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

# Mary:

Alum. Iron Phos. Silica Mang. Lime Magnes. Sulph. Loss 58.73 .103 8.35 .23 2.98 .62 .63 .026 2.59

Charlotte:

Phos. Iron Silica Mang. Alum. Sulph. Lime Magnes. Loss 54.35 .090 14.60 .45 2.85 .81 1.40 .022 1.96 The Ore in its natural state is as follows:

Marv.

Moist Iron Phos. Silica 13.47 50.82 .089 7.23

Charlotte:

Moist Iron Phos. Silica 11.56 48.07 .079 12.91

## MARY CHARLOTTE NO. 2.

Location: Marquette County, Michigan, N. W. 1/4, S. W. 1/4 of Section 8, Township 47 North, Range 26 West.

Description: First opened up in 1908. Two ores are shipped from this mine, MARY and CHARLOTTE, soft, red, Non-Bessemer Hematites.

The mine is worked by the caving system. Greatest vertical depth 470 feet.

The ore is shipped via the D. S. S. & A. and C. & N. W. Railways to Marquette and Escanaba, and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co., Cleveland.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mary:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.73 8.35 .23 2.98 .026 2.59 .103 .62 .63 Charlotte:

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron 54.35 .090 14.60 .45 2.85 .81 1.40 .022 1.96 The Ore in its natural state is as follows:

Mary:

Moist Iron Phos. Silica 13.47 50.82 .089 7.23

Charlotte:

Moist Iron Phos. Silica 11.56 48.07 .079 12.91

#### MILWAUKEE-DAVIS MINE.

Location: Marquette County, Michigan, Section 7, Township 47 North, Range 26 West.

Description: First opened up in 1879. Two ores are shipped from this mine, MILWAUKEE and DAVIS, both soft, red, Non-Bessemer Hematites.

Greatest vertical depth is 373 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette, and from there by boat to the lower lake ports. The mine was shut down in 1890, but is now being opened up and developed.

Sales Agents: E. N. Breitung & Co., Cleveland

Yearly Shipments:

MILWAUKEE	Total, Tons375,431
1879— 941 tons `	DAVIS (formerly
1880— 13,142 tons	Grand Rapids,
1881— 31,635 tons	1887— 1,200 tons
1882— 40,891 tons	1888— 11,611 tons
1883— 805 tons	1889— 20,058 tons
1884— 25,991 tons	1890— 26,426 tons
1885— 38,465 tons	1891— 9,362 tons
1886— 46,693 tons	1892— 22,823 tons
1887— 50,470 tons	1893— 352 tons
1888— 48,908 tons	1894— 12,073 tons
1889— 52,727 tons	1895— 6,764 tons
1890— 24,763 tons	1896— 67 tons
Total Tons	110.736

Analysis: Expected analysis for season of 1911 is as follows:
Dried at 212° F.

#### Milwaukee:

Iron 62.05	Phos105	Silica 4.32	Mang. .45	Alum. .60	Lime 1.10	Magnes. .90	Sulph.	Loss 2.10
<b>~</b> ·								

#### Davis:

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
61.40	.127	5.25	.45	1.19	1.10	.72	.02	2.08

The Ore in its natural state is as follows:

#### Milwaukee:

Moist Iron Phos. Silica 10.00 55.85 .095 3.89

#### Davis:

Moist Iron Phos. Silica 10.00 55.26 .114 4.73

#### MORO MINE.

Location: Marquette County, Michigan, Section 10, Township 47, Range 27.

Description: First opened up in 1881. SCOTCH ore shipped from this mine. It is a hard, Non-Bessemer, Specular.

The mine is worked by the open, over hand stoping system. Greatest vertical depth 812 feet.

The ore is shipped via the L. S. & I. Railway to Presque Isle

and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

1892— 42,916 tons	1902— 68,811 tons
1893— 25,824 tons	1903— 72,441 tons
1894— 23,012 tons	1904— 1,993 tons
1895— 12,737 tons	1905—121,295 tons
1896— 28,003 tons	1906—106,154 tons
1897— 12,678 tons	1907— 77,292 tons
1898—	1908— 661 tons
1899— 5,459 tons	1909— 47,074 tons
1900— 72,124 tons	1910—125,430 tons
1901—	•

Total, Tons .......843,904

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.30 .140 8.40 .12 2.72 .58 .12 .020 .30

The Ore in its natural state is as follows:

Moist Iron Phos. Silica .50 60.00 .139 8.36

# NEGAUNEE MINE.

Location: Marquette County, Michigan, Sections 5 and 6, Township 47, Range 26.

Description: First opened up in 1887. Two ores are shipped from this mine, NEGAUNEE, a soft, Non-Bessemer Hematite; and NEGAUNEE BESSEMER, a soft, Bessemer Hematite.

The mine is worked by the caving system. Greatest vertical depth 686 feet.

The ore is shipped via the L. S. & I., C. & N. W. and D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

# Yearly Shipments:

1887— 5,259	tons	1899—195,573 tons
1888— 45,304	tons	1900—126,829 tons
1889— 78,318	tons	1901—234,713 tons
1890— 76,488	tons	1902—204,286 tons
1891— 64,218	tons	1903—224,665 tons
1892— 85,846	tons	1904—145,132 tons
1893— 69,732	tons	1905—239,554 tons
1894—132,581	tons	1906—253,488 tons
1895— 90,682	tons	1907—296,170 tons
1896—175,394	tons	1908—232,219 tons
1897—182,169	tons	1909—312,217 tons
1898—191;330	tons	1910—348,818 tons
•	Total Tons	4 010 945

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Negaunee:

Phos. Mang. Iron Silica Alum. Lime Magnes. Sulph. Loss 58.80 .089 8.50 .25 2.56 1.23 .27 .018 2.60

Negaunee Bessemer:

Silica Phos. Mang. Alum. Lime Magnes. Sulph. Loss Iron .24 2.20 59.80 .060 7.65 2.69 1.12 .23 .013

The Ore in its natural state is as follows:

Negaunee:

Moist Iron Phos. Silica 11.50 52.04 .079 7.52

Negaunee Bessemer:

Moist Iron Phos. Silica 11.00 53.22 .053 6.81

# OHIO MINE (Formerly Beaufort Mine).

Location: Baraga County, Michigan, Section 22, Township 48 North, Range 31 West.

**Description:** First opened up in 1881. Ore is a soft, brown, Non-Bessemer Hematite.

It is an underground mine.

The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Escanaba and Marquette and from there to the lower lake ports by boat.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1882— 5,532 ton	S	1902— 59,781 tons
1883— 18,976 ton	S	1903—134,648 tons
1884— 18,360 ton	S	1904— 25,781 tons
1885— 17,166 ton	S	1905— 38,306 tons
1886— 17,354 ton	s	1906—
1887— 12,829 ton	s	1907— 78,029 tons
1888-1899		1908— 61,035 tons
1900— 1,583 ton	S .	1909— 72,987 tons
1901— 4,338 ton	S	1910— 23,427 tons
	Total Tons	590.132

#### OGDEN MINE.

Location: Marquette County, Michigan, Section 13, Township 47, Range 27.

**Description:** Opened up about forty years ago. The ore is called TILDEN SILICA, a hard, silicious Hematite.

It is a quarry on a side hill, all above the Railway.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

Prior to 1898— 1898— 50,833 tons 1899— 27,345 tons 1900— 15,325 tons 1901— 10,642 tons 1902— 4,621 tons 986

Total Tons ......109,752

Expected analysis for season of 1911 is as follows: Dried at 212° F.

Phos. Alum. Iron Silica Mang. Lime Magnes. Sulph. 41.70 .045 37.10 .37 .69 .13 1.20

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 1.34 41.14 .044

### PORTLAND MINE.

Baraga County, Michigan, Section 26, Township 48 Location: North, Range 31 West.

**Description:** First opened up in 1909. The ore is a soft, yellow, Non-Bessemer Hematite and Limonite.

It is an open pit mine, operated with the steam shovel. Greatest vertical depth 40 feet. This mine is controlled by Rogers Brown Iron Co.

The ore is shipped via the D., S. S. & A. Railway to docks at Marquette, and via the C. & N. W. Railway to docks at Escanaba, and from there to the lower lake ports by boat.

# Yearly Shipments:

1910-49,584 tons

#### PRINCETON MINE.

Marquette County, Michigan, Sections 18 and 20, Township 45, Range 25.

**Description:** First opened in 1872. There are two ores shipped from this mine, PRINCETON and CAMBRIDGE, soft, Non-Bessemer Hematites.

Mine is worked by the caving system. Greatest vertical depth 383 feet.

The ore is shipped via the C. & N. W. and Munising Railways to Escanaba and Presque Isle and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

## Yearly Shipments:

Swanzey and Cheshire Com-	PRINCETON
bined.	1891— 7,301 tons
1872— 13,415 tons	1892— 29,403 tons
1873— 9,329 tons	1893— 19,096 tons .
1874—	1894—
1875— 188 tons	1895— 6,593 tons
1876— 225 tons	1896—
1877— 8.423 tons	1897—
1878— 16,924 tons	1898— 25,247 tons
1879— 17,985 tons	1899— 55,802 tons
1880— 13,202 tons	1900— 75,037 tons
1881— 5,674 tons	1901— 67,051 tons
ŚWANZEY	1902—118,048 tons
1881— 9,337 tons	1903— 84,223 tons
1882— 31,498 tons	1904— 76,461 tons
1883— 13,730 tons	1905—129.079 tons
1884— 3,557 tons	1906—166,894 tons
1885—	1907—177,863 tons
1886— 8,328 tons	1908— 36,033 tons
1887— 2,842 tons	1909— 42,934 tons
1888—	1910— 89,441 tons
1889—	
1890—	•

Total, Tons ......1,361,202

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Princeton:

				Magnes. .62	
Cambride	re.				

Tron Phos. Silice Mang. Alum. Lime Magnes. Sulph. Loss 60.00 .667 6.12 .74 1.07 2.15 .42 .014 1.25

The Ore in its natural state is as follows:

#### Princeton:

Moist Iron Phos. Silica 14.00 51.34 .169 7.56

Cambridge:

Moist Iron Phos. Silica 14.00 51.60 574 5.26

## QUEEN MINE.

Location: Marquette County, Michigan, Section 5, Township 47, Range 26.

Description: First opened up in 1888. Two ores are shipped from this mine, BUFFALO and CAMEO, hard, and soft, dark red, Non-Bessemer Hematites.

It is an underground mine. Greatest vertical depth 923 feet. The ore is shipped via the C. & N. W. and D. S. S. & A. Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

# Yearly Shipments:

1888— 5,527 tons	1900—398,298 tons
.1889— 66,122 tons	1901—400,845 tons
1890—141,632 tons	1902—418,044 tons
1891—479,509 tons	1903—254,658 tons
1892-379,719 tons	1904—311,479 tons
1893106,864 tons	1905—253,377 tons
1894—220,298 tons	1906—221,096 tons
1895—160,817 tons	1907—309,917 tons
1896—323,057 tons	1908—104,098 tons
1897—239,774 tons	1909—237,509 tons
1898— 61,022 tons	1910—230,119 tons
1899—342.978 tons	

Total, Tons .....6,222,540

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

#### Buffalo:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.02 .112 6.18

#### Cameo:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.24 .104 8.77

The Ore in its natural state is as follows:

#### Buffalo:

Moist Iron Phos. Silica 14.36 51.40 .096 5.30

### Cameo:

Moist Iron Phos. Silica 14.41 48.99 .089 7.51

## REPUBLIC MINE.

Location: Marquette County, Michigan, Section 7, Township 46, Range 29.

Description: First opened up in 1872. Ore is principally Specular, a small part being Magnetite. Four ores are shipped from this mine, REPUBLIC, a hard, blue and black Bessemer; and KINGSTON, BASIC and LUMP, hard, blue and black, Non-Bessemer. Ore is crushed.

It is worked by the underhand stoping system, using broken ore to stand on. Greatest vertical depth 1,950 feet.

The ore is shipped via the D., S. S. & A., C. M. & St. P. and C. N. & W. Railway to Marquette and Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

```
Yearly Shipments:
         1872— 11,025 tons
1873—105,453 tons
1874—122,639 tons
                                                   1892—167,991 tons
1893— 64,195 tons
                                                   1894-105,719 tons
         1875—119,726 tons
                                                   1895—174,027 tons
         1876-120,095 tons
                                                   1896—127,360 tons
                                                   1897—124,342 tons
         1877—165,836 tons
         1878-176,221 tons
                                                   1898-140,312 tons
         1879—135,231 tons
1880—235,387 tons
1881—233,786 tons
                                                   1899-137,085 tons
                                                   1900-130,126 tons
                                                   1901-104,604 tons
         1882-235,109 tons
                                                   1902—157,646 tons
         1883
              -152,565 tons
                                                   1903-
                                                         -155,415 tons
         1884-
               -277,757 tons
                                                   1904—124,506 tons
         1885-
                                                  1905—150,699 tons
1906—177,220 tons
               -250,835 tons
         1886-
               -241,161 tons
                -220,624 tons
                                                   1907—170,554 tons
         1887-
         1888-235,062 tons
                                                   1908- 67,999 tons
         1889-287,390 tons
                                                   1909—176,575 tons
         1890-220,065 tons
                                                   1910-150,732 tons
         1891-191,127 tons
                           Total, Tons ......6,344,203
Analysis:
              The average of all cargo analysis for 1910 is as fol-
              Dried at 212° F.
     lows:
  Republic:
              Phos.
     Iron
                       Silica Mang.
                                        Alum.
                                                  Lime
                                                         Magnes.
                                                                    Sulph.
                                                                              Loss
     62.80
              .049
                       7.93
                                  .04
                                          1.44
                                                    .56
                                                                     .028
                                                                                .28
                                                             .61
  Basic:
              Phos.
                       Silica
     Iron
                               Mang.
                                        Alum.
                                                  Lime
                                                         Magnes.
                                                                    Sulph.
                                                                              Loss
     63.65
              .077
                        5.54
                                          1.50
                                                    .56
                                                             .90
                                                                     .027
                                                                                .14
                                  .06
  Lump:
     Iron
              Phos.
                       Silica
                               Mang.
                                         Alum.
                                                  Lime
                                                         Magnes.
                                                                    Sulph.
                                                                              Loss
     66.40
              .094
                       2.36
                                           .95
                                                             .72
                                                                     .012
                                  .06
                                                    .52
                                                                              None
     The Ore in its natural state is as follows:
  Republic:
     Moist
            Iron
                    Phos.
                           Silica
        .96
             62.20
                      .049
                           7.85
  Basic:
     Moist
             Iron
                    Phos.
                            Silica
             62.80
                      .076
      1.33
  Lump:
     Moist
                    Phos.
                            Silica
             Iron
```

#### RICHMOND MINE.

.82

65.86

.093

2.34

Location: Marquette County, Michigan, Section 28, Township 47, Range 26.

**Description:** First opened up in 1896. Ore is hard, red. silicious Hematite, and is crushed. It is an open pit mine.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports. The mine is operated by the Richmond Iron Co.

Sales Agents: M. A. Hanna Co., Cleveland.

Yearly Shipments:

1896— 1,088 tons		1904— 68,134 tons
1897— 4,630 tons		1905— 86,129 tons
1898— 24,464 tons		1906— 89,563 tons
1899— 4,613 tons		1907— 35,156 tons
1900— 51,303 tons		1908— 60,994 tons
1901— 54,181 tons	-	1909—102,566 tons
1902— 50,041 tons		1910— 95,772 tons
1003 55 503 tone		•

Total, Tons ......784,227

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 40.90 .040 38.10 .12 .81 .35 .80 .014 1.31

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 3.03 39.66 .039 36.95

### ROLLING MILL MINE.

Location: Marquette County, Michigan, City of Negaunee.

Description: First opened up in 1872. Ore is a soft, red, Non-Bessemer Hematite.

Mine is worked by the underground slicing system. Greatest vertical depth 698 feet.

The ore is shipped via the L. S. & I., D. S. S. & A., and C. & N. W. Railway to L. S. & I. docks, Marquette, and from there by boat to the lower lake ports.

The mine is operated by Jones & Laughlin Ore Co.

Yearly Shipments:

ompinents.		
1872— 6,772	tons	1888— 402 tons
1873— 11,319	tons	1897— 3,975 tons
1874 16,643	tons	1898—
1875— 37,806	tons	1899
1876— 53,265	tons	1900— 22,585 tons
1877— 38,121	tons	1901— 22,815 tons
1878— 30,773	tons	1902— 24,874 tons
1879 10,039	tons	1903— 6,786 tons
1880 15,172	tons	1904—
1881— 1,668	tons	1905— 28,766 tons
1882— 163	tons	1906—
1883 1,528	tons	1907— 49,204 tons
1884— 1,820	tons	1908— 52,147 tons
1885— 3,437	tons	1909—133,139 tons
1886 4,403	tons	1910—115,193 tons
1887 1,058	tons	ŕ

Total, Tons .......694,109

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.76 .102 8.25

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.65 51.60 .088 7.12

## SALISBURY MINE.

Location: Marquette County, Michigan, Section 15, Township 47, Range 27.

Description: First opened up in 1872. Three ores are shipped from this mine, CLINTON, a soft, Non-Bessemer Hematite; CLINTON SILICA, a soft, silicious Hematite; and SALISBURY, a soft, Non-Bessemer Hematite.

The mine is worked by caving system. Greatest vertical depth is 900 feet.

The ore is shipped via the L. S. & I., C. & N. W., D. S. S. & A. Railways to Presque Isle and Escanaba and from there by boat to the lower lake ports.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

ompinents.	
SALISBURY	1882— 42,243 tons
1872— 440 tons	1883— 17,028 tons
1873— 11,023 tons	1884— 26,629 tons
1874— 7,480 tons	1885— 29,503 tons
1875— 4,330 tons	1886— 51,667 tons
1876— 20,315 tons	1887— 48,304 tons
1877— 37,660 tons	1888— 74,947 tons
1878— 52,155 tons	1889— 72,449 tons
1879— 39,293 tons	1890— 85,798 tons
1880— 21,457 tons	1910— 85,098 tons
1881— 43.690 tons	•

Total, Tons .......771,509

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Clinton:

Clinton:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
60.50	.220	6.75	.30	2.30	.70	.23	.014	2.57
Clinton S	ilica:							
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
51.50	.106	19.35	.26	2.46	.30	.16	.0Ì2	2.68
Salisbury	:							

Phos. Silica Alum. Lime Magnes. Mang. Sulph. Loss 2.50 59.10 .110 7.00 .60 3.00 1.20 1.20 .040

The Ore in its natural state is as follows:

Clinton:

Moist Iron Phos. Silica 12.00 53.24 .194 5.94 Clinton Silica:

Moist Iron Phos. Silica 12.50 45.06 .093 16.93

Salisbury:

Moist Iron Phos. Silica 14.00 50.83 .095 6.02

# STAR WEST MINE (formerly Wheat Mine).

Location: Marquette County, Michigan, Section 29, Township 47, Range 26.

Description: First opened up in 1879. Ore is a soft, blue, silicious, Bessemer Hematite. Ore is crushed.

It is an underground mine.

Sales Agents; Corrigan, McKinney Co., Cleveland.

Yearly Shipments:

Ompin	iciico.				
1879—	851	tons	1891—	4,412	tons
1880—	3,323	tons	1892—		
1881	9,040	tons	1893		
				942	tons
			1900—	15,987	tons
1890—	15,141	tons			
	1879— 1880— 1881— 1882— 1883— 1884— 1885— 1886— 1887— 1888— 1889—	1880— 3,323 1881— 9,040 1882— 9,554 1883— 6,625 1884— 6,824 1885— 9,200 1886— 15,867 1887— 17,538 1888— 4,987 1889— 7,997	1879— 851 tons 1880— 3,323 tons 1881— 9,040 tons 1882— 9,554 tons 1883— 6,625 tons 1884— 6,824 tons 1885— 9,200 tons 1886— 15,867 tons 1887— 17,538 tons 1888— 4,987 tons 1889— 7,997 tons 1890— 15,141 tons	1879     851 tons     1891       1880     3,323 tons     1892       1881     9,040 tons     1893       1882     9,554 tons     1894       1883     6,625 tons     1895       1884     6,824 tons     1896       1885     9,200 tons     1897       1886     15,867 tons     1898       1887     17,538 tons     1899       1889     7,997 tons     1900	1879—     851 tons     1891—     4,412       1880—     3,323 tons     1892—       1881—     9,040 tons     1893—       1882—     9,554 tons     1894—     5,550       1883—     6,625 tons     1895—     51,207       1884—     6,824 tons     1896—     9,658       1885—     9,200 tons     1897—     942       1886—     15,867 tons     1898—       1887—     17,538 tons     1899—     6,716       1888—     4,987 tons     1900—     15,987       1889—     7,997 tons

Total, Tons ......204,649

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 1.12 54.16 .037 18.42 .21 .76 1.10 .85 .002 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 1.76 53.21 .036 18.09

### STEGMILLER MINE.

Location: Marquette County, Michigan, Section 17, Township 45, Range 25.

Description: First opened up in 1909. Ore is a hard and soft, silver blue, Non-Bessemer Hematite.

It is an underground mine. Greatest vertical depth 346 feet.

The ore is shipped via the C. & N. W. Railway to Escanaba and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

Analysis:

1909— 39,869 tons 1910— 4 Total, Tons ......88,711

1910— 48,842 tons

The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.34 .381 6.97

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.74 51.44 .325 5.95

#### STEPHENSON MINE.

Location: Marquette County, Michigan, Section 20, Township 45, Range 25.

**Description:** First opened up in 1904. Ore is a soft, Non-Bessemer Hematite.

Mine is worked by the caving system. Greatest vertical depth 413 feet.

The ore is shipped via the Munising and C. & N. W. Railways to Presque Isle and Escanaba and from there to the lower lake ports by boat.

Sales Agents: Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

1907— 6,305 tons 1908— 52,588 tons 1909— 64,075 tons 1910—225,726 tons

Total, Tons ......348,694

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.00 .667 6.12 .74 1.07 2.15 .42 .014 1.25

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.00 51.60 .574 5.26

#### VOLUNTEER MINE.

Location: Marquette County, Michigan, South ½ of Southwest ¼, Section 30, Township 47, Range 26 West.

**Description:** First opened up in 1871.

The mine is idle and has been for the past three years.

The ore is shipped via the C. & N. W., and D. S. S. & A, Railways to Marquette and Escanaba and from there by boat to the lower lake ports.

# Yearly Shipments:

-		
1871— 4,171 tons	3	1890—141,524 tons
1872 39,495 tons	3	1891— 92,699 tons
1873— 41,204 tons	3	1892—127,130 tons
1874— 16,106 tons	3	1893— 69,561 tons
1875— 4,070 tons		1894— 26,946 tons
1876— 15,324 tons	3	1895— 32,672 tons
1877— 20,211 tons	3	1896— 53,216 tons
1878— 5,929 tons	3	1897— 1,617 tons
1879— 24,663 tons		1898—
1880— 38,881 tons	3	1899— 29,983 tons
1881— 39,276 tons	3	1900— 47,578 tons
1882— 41,456 tons	3	1901—
1883— 19,414 tons	3	1902— 32,736 tons
1884— 11,748 tons	3	1903— 7,395 tons
1885— 5,679 tons	3	1904— 71,870 tons
1886— 24,034 tons	3	1905—106,281 tons
1887— 47,486 tons	3	1906— 38,544 tons
1888— 56,321 tons	3	1907— 10,022 tons
1889— 60,156 tons	•	·
	Total, Tons	1,405,398

### WASHINGTON MINE.

Location: Marquette County, Michigan, Section 11, Township 47 North, Range 29 West.

Description: First opened up in early sixties. Three grades of ore are shipped from this mine, WASHINGTON, WASHINGTON NO. 2, and WASHINGTON SILICIOUS, all hard, steel gray, Non-Bessemer Specular Hematite. Crushed to one inch size.

The mine is worked by back stoping and underhand system. Greatest vertical depth 572 feet.

The ore is shipped via the D. S. S. & A. Railway to Marquette and from there by boat to the lower lake ports. Mine was idle several years and reopened in 1908 by Washington Iron Co. Old name, Barron Mine.

Sales Agents: E. N. Breitung & Co., Cleveland.

# Yearly Shipments:

HUMBOLT	1872— 38,841 tons
1865— 4,782 tons	1873— 38,014 tons
1866— 15,150 tons	1874— 27,890 tons
1867— 25,440 tons	1875— 9,642 tons
1868— 35,757 tons	1876— 3,333 tons
1869— 58,462 tons	1877— 16,545 tons
1870— 79,762 tons	1878— 33,920 tons
1871— 48,725 tons	1879— 18,204 tons

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1880- 14,726 tons
                                               1891- 19,879 tons
                                               1892— 4,571 tons
        1881— 26,302 tons
        1882-43,463 tons
                                               1893---
        1883- 31,866 tons
                                               1894-
                                               1895-
              - 23,763 tons
        1884-
        1885— 11,766 tons
1886— 20,207 tons
1887— 19,873 tons
                                               1896— 2,297 tons
                                               .723,961
        1888-
              - 11,655 tons
                                               1908— 20,625 tons
        1889— 15,866 tons
                                               1909-44,716 tons
                                               1910-96,769 tons
        1890— 23,259 tons
                         Total, Tons ......162,110
Analysis:
             The average of all cargo analysis for 1910 is as fol-
    lows: Dried at 212° F.
  Washington:
             Phos.
                                                              Sulph.
    Iron
                     Silica
                             Mang.
                                     Alum.
                                              Lime Magnes.
                                                                        Loss
             .137
                     10.43
                                      1.52
                                                .93
                                                        .84
                                                                .021
    60.20
                              .06
  Washington No. 2:
                                                     Magnes.
                                                                        Loss
             Phos.
                     Silica
                                              Lime
                                                               Sulph.
    Iron
57.12
                             Mang.
                                      Alum.
             .123
                     14.03
                               .33
                                       1.68
                                                .66
                                                         .62
                                                                .016
                                                                        1.60
  Washington Silicious:
                     Silica
                             Mang.
                                     Alum.
                                              Lime
                                                     Magnes.
                                                               Sulph.
                                                                        Loss
    Iron
             Phos.
                                                                          .42
     50.00
                     25.00
                               .44
                                      .84
                                                .88
                                                                .031
             .100
                                                        .10
     The Ore in its natural state is as follows:
  Washington:
     Moist Iron
                   Phos. Silica
       .98
           59.61
                   .136
                         10.33
  Washington No. 2:
     Moist Iron
                   Phos.
                          Silica
                    .122
       .77
           56.68
                          13.92
  Washington Silicious:
    Moist Iron Phos.
1.00 49.50 .099
                          Silica
                          24.75
```

# MICHIPICOTON RANGE

### HELEN MINE.

Location: Michipicoton, Ont.

Description; First opened up in 1900. Two ores are shipped from this mine, HELEN No. 1 and HELEN No. 2, both brown, hard, Non-Bessemer Hematites. The underground long wall system of mining is used. The greatest vertical depth is 480 feet. The ore is shipped via Algoma Central Railway to Michipicoton Harbor Dock, and from there by boat.

The ore is crushed to pass a 2½ inch ring.

Sales Agents: R. A. Seelye, Sault Ste. Marie, Ont.

Yearly Shipments:

Prior to 1904—803,160 tons 1907—142,832 tons 1904—118,354 tons 1908—148,420 tons 1905—169,526 tons 1906—121,550 tons 1906—121,550 tons 1906—121,550 tons 1906—121,550 tons 1906—121,550 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Helen No. 1: Alum. Silica Mang. Lime Magnes. Sulph. Loss Iron Phos. 57.77 10.40 .127 4.40 .17 .88 .23 .44 .136

Helen No. 2: Lime Magnes. Sulph. Iron Phos. Silica Mang. Alum. Loss 57.19 4.40 .17 .88 .14 .447 10.40 .127

The Ore in its natural state is as follows:

Helen No. 1:

Moist Iron Phos. Silica
5.70 54.41 .120 4.15

Helen No. 2: Moist Iron Phos. Silica 5.70 53.93 .120 4.15

# GOGEBIC RANGE

## ANVIL MINE.

Location: Gogebic County, Michigan, Section 14, Township 47 North, Range 46 West.

Description: First opened up in 1887. Three ores are shipped from this mine, ANVIL and ROWE, both soft, red, Bessemer Hematites; and ROWE No. 2, a soft, red, Non-Bessemer Hematite. Sub-slicing system of mining is used. The greatest vertical depth is 1,700 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

## Yearly Shipments:

<del></del>			
1887— 10,075 tons		1900—	
1888— 24,676 tons		1899	
1889— 47,000 tons		1901— 1,101 to	
1890— 45.690 tons		1902—135,502 to	ns
1891— 73 tons		1903— 11,309 to	ns
1002 42 000 4		1004 45 505 4	
1892— 42,090 tons	<b>A</b>	1904— 45,595 to	
1893—	•	1905— 82,118 to	
1093		1903 02,110 to	ns
1894— 13,297 tons		1906— 79,493 to	
1895— 68,064 tons		1907— 39,495 to	no
1896— 57.483 tons		1908— 35,937 to	ns
1897		1909— 22,927 to	ns
1000 5 027 4			
1898— 5,037 tons	,	1910— 7,235 to	ns
•	Total Toma	774 107	
	Total, Tons		

#### ASTEROID MINE.

Location; Gogebic County, Michigan, Section 13, Township 47, Range 46.

Description: First opened up in 1906. The ore is soft, red, Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 884 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

## ASHLAND MINE.

Location: Gogebic County, Michigan, Section 22, Township 47, Range 47.

Description: First opened up in 1884. This mine ships two ores, ASHLAND, a soft, red, Bessemer Hematite; and GLOBE, a soft, red, Non-Bessemer Hematite. Sub-level with top slicing and caving systems of mining are used. The greatest vertical depth is 1,324 feet.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by

boat to the lower lake ports.

Sales Agents: The Cleveland Cliffs Iron Co., Cleveland.

Yearly Shipments:

ompinion.		
1885— 6,741 tons		1898—123,208 tons
1886— 74,015 tons		1899—154,615 tons
1887—175,563 tons		1900—232,961 tons
1888—174,183 tons		1901—286,399 tons
1889—257,915 tons		1902—301,824 tons
1890—435,946 tons		1903—274,138 tons
1891—267,439 tons		1904—344,102 tons
1892—231,896 tons		1905—409,131 tons
1893— 66,067 tons		1906—241,841 tons
1894— 83,020 tons		1907—298,056 tons
1895—126,096 tons		1908—259,611 tons
1896— 91,149 tons		1909—259,612 tons
1897—111,625 tons		1910—231,506 tons
,	Total, Tons	5,618,390

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Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

A shland ·

Iron 58.00	Phos048	Silica 10.35	Mang.	Alum. 3.03	Lime .27	Magnes.	Sulph. .010	Loss 2.78
Globe: Iron 57.85	Phos103	Silica 11.00	Mang. .28	Alum. 2.87	Lime .53	Magnes. .47	Sulph. .017	Loss 2,20

The Ore in its natural state is as follows:

Ashland:

Moist Iron Phos. Silica 10.60 51.85 .043 9.25

Globe:

Moist Iron Phos. Silica 10.00 52.06 .093 9.90

### ATLANTIC MINE.

Location: Iron County, Michigan, Sections 1 and 12, Township 45, Range 1.

Description: First opened up in 1887. The ore is a hard and soft, reddish brown, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,208 feet.

The ore is shipped via the Minneapolis, St. Paul & Sault Ste. Marie and Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

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Yearly Shipments:
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1887— 1,369 tons	1899— 19,964 tons
1888—	1900—135,955 tons
1889—	1901—190,135 tons
1890—	1902—190,213 tons
1891—	1903—148,385 tons
1892—	1904— 77,424 tons
1893	1905—208,039 tons
1894	1906— 97,689 tons
1895— 70,989 tons	1907— 91,759 tons
1896— 60,727 tons	1908— 41,465 tons
1897— 50,307 tons	1909—124,845 tons
1898— 38,058 tons	1910— 79,847 tons
T-4-1 T	1 (2( 070

Total, Tons ......1,626,970

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.85 .035 10.15 .33

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.25 53.11 .031 9.01

### BROTHERTON MINE.

Location: Gogebic County, Michigan, Section 9, Township 47, Range 45 West.

Description: First opened up in 1886. The mine ships BROTH-ERTON and BROTHERTON No. 2, both Bessemer Hematite; and WALTON, a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,075 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

### Yearly Shipments:

ompinents.			
1886— 8,880	tons	1899— 78,858	tons
1887— 21,721	tons	1900 89,804	tons
1888— 40,639	tons	1901—103,109	tons
1889— 53,267	tons	1902— 53,255	tons
1890— 80,486	tons	1903— 94,986	
1891— 46,574	tons	1904— 84,870	tons
1892—130,833	tons	1905—137,351	
1893 18,905	tons	1906—147,281	tons
1894— 47,148	tons	1907—104,224	tons
1895— 40,567	tons	1908— 96,776	
1896— 50,496		1909—103,090	tons
1897— 46,186	tons	1910—102,626	tons
1898 73 198	tons		

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows: Brotherton: Silica Mang. Phos. Iron Alum. Lime Magnes. Sulph. Loss 62,20 .027 8.59 .42 .82 .24 .26 .006 .64 Brotherton No. 2: Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 61.00 .045 10.30 .42 .82 .24 .26 .006 .64 Walton: Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 61.00 .085 10.30 .42 .64 .82 .24 .26 .006

Brotherton:

Moist Iron Phos. Silica 8.50 56.91 .025 7.86

Brotherton No. 2:

Moist Iron Phos. Silica 8.50 55.82 .041 9.42

Walton:

Moist Iron Phos. Silica 8.50 55.82 .078 9.43

#### CARY MINE.

Location: Iron County, Wisconsin, Sections 26 and 27, Township 46, Range 2 East.

Description: First opened up in 1886. This mine ships five ores: CARY EMPIRE, CARY BESSEMER, and WIND-SOR, all Bessemer Hematite; and KAKAGON and NIMI-KON, both Non-Bessemer Hematite. The underground system of mining is used.

The greatest vertical depth is 1,198 feet.

The Ore in its natural state is as follows:

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Odanah	•	Cary.
1886 13,714	tons	1889— 56,542 tons
1887— 30,475		1890—116,203 tons
1888— 5,412		1891—121,186 tons
1889— 13,354	tons	1892—106,484 tons
1890— 1,065		1893— 31,052 tons
1891—121,318		1894— 47,156 tons
1892— 6,711		1895— 63,787 tons
1893— 3,956		1896— 66.975 tons
1894— 2,437		1897— 37,693 tons
Kakagon		1898— 43,162 tons
1886— 18,487	tons	1899— 62,524 tons
1887— 52,179		1900—125,984 tons
1888— 1,228		1901—180,215 tons
1,000	tons	1902—136.895 tons
		1903— 89,221 tons

190 190 190	5—146, 6—216, 7—209,	860 to: 414 to: 992 to: 407 to: 358 to:	ns ns ns	·	1910- Nimi 1886- 1887- 1888-	4,105 t 23,217 t 1,313 t	ons ons	
					2,745,			
	The	avera	ge of a	ll cargo	analysi	s for 19	10 is as	s fol-
lows:		d at 2	12° F.					
Cary Emp								_
Iron	Phos.	Silic			i. Lime	Magnes.		Loss
53.20 Cary Bess	.056	12.22	2 4.14	.93	.19	.16	.010	4.62
Iron	Phos.	Silio	a Man	g. Aluı	n. Lime	Magnes	Sulp.	Loss
	.046	12.80				.19	.010	3.18
Windsor:								
Iron	Phos.						Sulph.	Loss
57.05	.046	12.80	.82	.96	.17	.19	.010	3.18
Kakagon:	Phos.	Silio	a Mans	z. Alun	'T ima	Magnes.	Sulph.	Loss
55.80	.076	9.67				.34	.007	4.54
Nimikon:			3,33				,,,,,	
Iron 58.00	Phos066	11.72	.36	1.15	.42	.33	Sulph. .013	Loss 2.88
The O	re in	its na	tural sta	ite is as	s follows	::		
Cary Emp								
Moist 9.00	Iron 48.41	Phos051	Silica 11.12					
Analysis:	Expe	ected	analysis	for se	eason of	1911 is	as fol	lows:
Dried	at 21	l2° F						
Cary Bess	semer:							
		Phos.	Silica					
	51.72	.042	11.60					
Windsor:	T	T)1	C:::					
Moist 9.30		Phos042	Silica 11.61					
Kakagon:		.042	11.01	•				
~		Phos.	Silica					
7.50 Nimikon:	51.62	.070	8.94		• •			
Moist	Iron 52.43	Phos060	Silica 10.60					
2.00	J2.10	.000						

### CASTILE MINE.

Location: Gogebic County, Michigan, Section 10, Township 47,

Range 45.

Description: First opened up in 1906. The mine ships two ores, CASTILE, a soft, red, Bessemer Hematite; and MEDINA, a soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,111 feet.

The ore is shipped vià the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports. Sales Agents: Oglebay, Norton & Co., Cleveland. .

Yearly Shipments:

1906— 2,108 tons 1909— 26,982 tons 1907— 6,157 tons 1910-20,197 tons 1908---

Total, Tons ......55,444

The average of all cargo analysis for 1910 is as fol-Analysis: lows: Dried at 212° F.

Castile:

Iron Phos. Silica Sulph. Mang. Alum. Lime Magnes. Loss 58.02 .045 13.98 .47 .56 .44 .45 .015 1.00 Medina: Phos. Silica Alum. Lime Sulph. Iron Mang. Magnes. Loss 57.35 .125 13.01 .60 .60 .39 .013 1.25

The Ore in its natural state is as follows:

Castile:

Moist Silica Phos. Iron 12.52 50.76 .039 12.23

Medina:

Moist Iron Phos. Silica 12.65 50.10 .109 11.36

### COLBY MINE.

Location: Gogebic County, Michigan, Section 16, Township 47, Range 46.

Description: First opened up in 1884. This mine ships two ores, COLBY, soft, blue, Bessemer Hematite; and COLBY No. 2, a soft, blue, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1884— 1,022 tons 1898-152,875 tons 1885— 84,302 tons 1899-103,239 tons 1886—257,432 tons 1887—258,518 tons 1888—285,880 tons 1900— 32,572 tons 1901- 23,475 tons 1902— 22,526 tons - 54,915 tons 1889—136,833 tons 1903-1890-193,038 tons 1904-- 81,141 tons 1891— 9,619 tons 1905— 83,736 tons 1892— 69,968 tons 1906—113,001 tons 1907— 94,480 tons 1908— 58,305 tons 1909—170,095 tons 1893— 59,346 tons 1894— 32,616 tons 1895— . 1896-48,492 tons 1910—194,754 tons 1897— 22,921 tons

Total, Tons ......2,645,101

Analysis: lows:		average d at 212		cargo a	analysis	for 19	10 is a	s fol-
Colby: Iron 60.05	Phos.	Silica 7.19	Mang. .32	Alum. 1.53	Lime .93	Magnes. .82	Sulph.	Loss 2.96
Colby No Iron 59.65 The C	Phos060	Silica 7.53 its natu	.38	1.40	1.05	Magnes. .91	Sulph. .007	Loss 3.09
Colby: Moist 10.40 Colby No Moist		.044 6	lica 5.44 lica					

## EUREKA MINE.

Location: Gogebic County, Michigan, Section 13, Township 47, Range 46.

Description: First opened up in 1890. This mine ships three ores: BELMONT, a soft, red, Bessemer Hematite; and EUREKA and RAMSAY, both soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. Greatest vertical depth 1,173 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

10.78 53.22

.054

Yearly Sh	ipment	s:						
	0 23,7				1901-	_		
189	13,9				1902-			
. 189	2— 10,6	55 tons			1903-	<del></del> .		
	31,3			•	1904			
	18,3				1905-			
	26,1					— <b>37,</b> 525 ·		
	6— 4,5	44 tons				<b>– 57,904</b> 1		
	7—					-122,324		
	) <del>8</del> —					-115,662		
189	79 20—				1910-	— <b>41</b> ,611	tons	
190	<i>.</i> 0—	То	tal, Tor	<b>n</b> e	503.5	745		
A	ть.		-		-		10 :	C-1
Analysis:				cargo	anaiysis	s for 19	10 is as	5 101-
lows:	Dried	at 212	F.					
Belmont:								
Iron	Phos.	Silica		Alum.		Magnes.		Loss
61.50	.055	6.65	.70	1.28	.40	.62	.022	2.10
Eureka:								_
Iron	Phos.	Silica		Alum.	Lime	Magnes.		Loss
62.59	.065	5.76	.83	1.37	.13	.34	.012	1.96
Ramsay:		~					~	_
Iron	Phos.	Silica		Alum.	Lime	Magnes.		Loss
61.48	.094	6.72	.63	1.70	.67	.39	.017	1.90

The Ore in its natural state is as follows:

Belmont:

Moist Iron Phos. Silica 15.31 52.08 .047 5.63

Eureka:

Moist Iron Phos. Silica 15.63 52.81 .055 4.86

Ramsay:

Moist Iron Phos. Silica 15.25 52.10 .080 5.70

# GERMANIA MINE (HARMONY IRON CO.)

Location: Iron County, Wisconsin, S. ½, S. W. ¼, Section 24 and undivided ¼ N. W. ¼, Section 25, Township 46, Range 2 East.

Description: First opened in 1883. The mine ships King ore, a soft, red, Non-Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 1,675 feet. The ore is shipped via the Chicago & Northwestern and the Minneapolis, St. Paul and Sault Ste. Marie Railways to Ashland, and from there by boat to the lower lake ports.

Yearly Shipments:

1885— 5,468 tons	1898—
1886— 19,734 tons	1899— 1,255 tons
1887— 61,714 tons	1900— 986 tons
1888— 53,918 tons	1901— 10,358 tons
1889—103,169 tons	1902— 20,502 tons
1890— 52,000 tons	1903— 2,246 tons
1891— 22,383 tons	1904— 23,364 tons
1892— 4,283 tons	1905— 2,973 tons
1893— 7.964 tons	1906— 9,436 tons
1894—	1907— 19,319 tons
1895—	1908—
1896—	1909— 152 tons
1897— 1,015 tons	1910— 20,080 tons
lotai, lons	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Loss

2.55

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. 55.50 .064 14.85 .27 1.19 .68 .55 .011

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.65 49.59 .057 13.27

### IRONTON MINE.

Location: Gogebic County, Michigan, Section 17, Township 47, Range 46.

Description: First opened up in 1886. The mine ships two ores, IRONTON, a soft, red, Bessemer Hematite; and IRONTON No. 2, soft, red, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by

boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

```
1886— 18,424 tons
                                         1899---
                                                 7,977 tons
1887— 24,762 tons
                                         1900— 25,047 tons
1888
                                         1901-
        8,635 tons
                                         1902-
1889-
                                                 8,555 tons
        6,247 tons
1890
                                         1903-
                                              – 16,875 tons

23,197 tons
41,314 tons

1891
          300 tons
                                         1904
1892-
                                         1905-
1893
                                         1906-106,158 tons
1894
                                         1907—190,986 tons
1895
                                         1908— 92,932 tons
1896
                                         1909-277,594 tons
1897-
                                         1910—109,925 tons
1898
```

Total, Tons .......958,910

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Ironton:

Phos. Silica Mang. Alum. Magnes. Sulph. Loss Iron Lime 60.02 .048 6.98 .006 3.12 .36 1.66 .81 .54

Ironton No. 2:

Sulph. Silica Alum. Magnes. Iron Phos. Mang. Lime Loss 59.68 .008 7.85 .35 1.82 .98 2.81 .061 .76

The Ore in its natural state is as follows:

Ironton:

Moist Iron Phos. Silica 10.55 53.69 .043 6.24

Ironton No. 2:

Moist Iron Phos. Silica 10.86 53.20 .054 6.99

#### MONTREAL MINE.

Location: Iron County, Wisconsin, Section 33, Township 46, Range 2.

Description: First opened up in 1886. The mine ships two ores, MONTREAL and LAWRENCE, both soft, red granular, Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,900 feet.

The ore is shipped via the Milwaukee, St. Paul & Sault Ste. Marie Railway to Ashland, and from there by boat to the

lower lake ports.

```
Sales Agents: Oglebay, Norton & Co., Cleveland.
Yearly Shipments:
         1886— 23,013 tons
                                                   1899—153,307 tons
         1887— 43,989 tons
                                                   1900—107,524 tons
1901— 72,945 tons
         1888--- 38,015 tons
         1889-42,724 tons
                                                   1902-136,354 tons
         1890— 16,728 tons
                                                   1903— 93,139 tons
         1891— 70,108 tons
                                                   1904—163,021 tons
         1892— 58,728 tons
                                                   1905—107,854 tons
                                                   1903—107,007 tons
1906—139,202 tons
1907—159,763 tons
1908—177,006 tons
1909—191,611 tons
         1893— 34,299 tons
         1894— 46,037 tons
1895—138,882 tons
         1896-131,531 tons
         1897—191,106 tons
                                                   1910—187,325 tons
         1898-270,776 tons
                           Total, Tons ......2,991,810
Analysis:
              The average of all cargo analysis for 1910 is as fol-
     lows:
              Dried at 212° F.
  Montreal:
     Iron
              Phos.
                       Silica
                                         Alum.
                                                                    Sulph.
                                Mang.
                                                  Lime
                                                         Magnes.
                                                                               Loss
     63.64
                       4.20
                                                                               3.82
              .045
                                  .38
                                           .92
                                                                      .004
                                                  trace
                                                           trace
  Lawrence:
              Phos.
                       Silica
                                         Alum.
                                                  Lime `Magnes.
     Iron
                                Mang.
                                                                    Sulph.
                                                                               Loss
     61.24
               .055
                        6.52
                                  .48
                                                                               4.00
                                          1.67
                                                    .35
                                                              .16
     The Ore in its natural state is as follows:
  Montreal:
     Moist
             Iron
                    Phos.
                            Silica
      9.80
             57.40
                      .041
  Lawrence:
     Moist Iron
10.70 54.69
                    Phos.
                            Silica
                     .049
                             5.82
```

#### MIKADO MINE.

Location: Gogebic County, Michigan, Section 18, Township 47, Range 45 West.

**Description:** First opened up in 1895. The ore is a red, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 938 feet.

The ore is shipped via the Chicago & North Western Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly	Shipm	ents:
•	1895—	4,788

1895— 4,788	tons		1903—108,709 tons
1896—			1904— 25,611 tons
1897— 11,397	tons		1905—140,740 tons
1898 <del>:</del> —			1906—154,043 tons
1899 10,324	tons		1907—163,891 tons
1900— 1,090	tons		1908— 86,617 tons
1901— 91,846	tons		1909— 99,195 tons
1902— 98,834			1910— 52,715 tons
	T-4-1	Т	1 040 000

Total, Tons ......1,049,800

e,

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 58.10
 .109
 11.03
 .90
 .87
 .73
 .37
 .008
 2.46

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.50 49.68 .093 9.43

## NEWPORT MINE.

Location: Gogebic County, Michigan, Section 24, Township 47 North, Range 47 West.

Description: First opened up in 1886. The mine ships five ores, MELROSE and NEW ERA No. 1, soft, red, Bessemer Hematite; MONTROSE and NEW ERA No. 2, soft, red, Non-Bessemer Hematite; BONNIE, soft, red, manganiferous, Bessemer Hematite. Sub-slicing system of mining is used. The greatest vertical depth is 2,200 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

Ompin	CIICS.						
1886—	20,184	tons		1899	<b>)</b> — :	263,711	tons
	75,660			1900	)— ;	217,201	tons
1888—	69,145	tons				190,448	
1889—	36,987	tons				141,571	
	71,488					279,905	
1891	105,606	tons		1904	—	171,931	tons
1892—	165,965	tons		1905	5— ·	438,023	tons
	109,718					549,745	
1894—	150,392	tons				551,496	
1895	157,821	tons				579,390	
1896—	142,369	tons		1909	)—1,	008,354	tons
1897—	150,979	tons		1910	<b>)—1</b> ,	182,324	tons
1898	196,953	tons					
		T-4-1	Т	7 027	262		

Total, Tons ......7,027,363

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F

lows:	Dried	at 212	r.					
Melrose: Iron 61.60	Phos045	Silica 5.98	Mang. .34	Alum. 2.70	Lime .67	Magnes. .17	Sulph. .014	Loss 2.12
New Era	No. 1:							
Iron 56.55	Phos. .047	Silica 12.61	Mang. .32	Alum. 2.97	Lime .63	Magnes. .14	Sulph. .020	Loss 1.93
Montrose	:							
Iron <b>60</b> .95	Phos. .078	Silica 6.60	Mang. .41	Alum. 1.63	Lime .35	Magnes. .56	Sulph. .033	Loss 3.13
New Era	No. 2:				•			
Iron 55.95	Phos080	Silica 12.63	Mang. .34	Alum. 3.18	Lime .60	Magnes. .26	Sulph. .015	Loss 2.67

Magnes.

.95

Lime

.20

Sulph.

.023

Loss

4.00

Bonnie: Iron Phos. Silica Mang. Alum. 48.35 .047 14.58 6.95 1.02 The Ore in its natural state is as follows: Melrose: Phos. Iron Silica Moist 11.61 54.45 .040 5.29 New Era No. 1: Iron Phos. Moist Silica 49.77 11.99 .041 11.10 Montrose: Phos. Silica Moist Iron 10.92 54.29 .069 5.88 New Era No. 2: Silica Moist Iron Phos. 10.52 50.06 .072 11.30 Bonnie: Phos. Moist Iron Silica · 7.66 44.65 .043 13.46

#### NORRIE-AURORA MINE.

Location: Gogebic County, Michigan, Sections 22 and 23, Township 47, Range 47.

**Description:** First opened up in 1884. The mine ships five ores: AURORA, NORRIE, NORDALE and VAUGHN, all reddish brown, hard and soft, Bessemer Hematite; and NOR-DEN, reddish brown, hard and soft, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,670 feet. Norrie Group includes Pabst Norrie, and Aurora ores.

The ore is shipped via the Chicago & Northwestern and the Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

ompinents:	
Pabst	1900—239,242 tons
1885— 1,103 tons	1901—198,686 tons
1886— 17,979 tons	Norrie
1887— 19,906 tons	1885— 15,419 tons
1888— 49,979 tons	1886— 124,844 tons
1889— 96,373 tons	1887— 237,254 tons
1890—172,060 tons	1888— 412,196 tons
1891—130,226 tons	1889— 674,394 tons
1892—113,245 tons	1890— 906,728 tons
1893—104,510 tons	1891— 758,572 tons
1894—206,074 tons	1892— 985,216 tons
1895—219,960 tons	1893— 472,062 tons
1896— 68,984 tons	1894— 621,608 tons
1897—220,496 tons	1895— 738,480 tons
1898—223,891 tons	1896— 329,068 tons
1899—263,869 tons	1897— 604,281 tons

```
700,990 tons
         1898—
                                                    1895-245,883 tons
         1899---
                 714,669 tons
                                                    1896—187,169 tons
                                                    1897-166,122 tons
         1900— 666,389 tons
         1901— 660,965 tons
                                                    1898—133,076 tons
                                                   1899—170,369 tons
1900—193,111 tons
1901—223,747 tons
1902—402,981 tons
         1902-1,080,032 tons
         Aurora
         1884
                  1,173 tons
         1885-
                  4,249 tons
         1886-
               - 94,553 tons
                                                    Norrie Group
         1887-159,252 tons
                                                    1903—1,145,711 tons
         1888-179,937 tons
                                                    1904— 831,558 tons
         1889-199,865 tons
                                                    1905-1,527,128 tons
                                                   1906—1,245,997 tons
1907—1,109,085 tons
1908— 773,243 tons
1909— 977,054 tons
         1890-246,695 tons
         1891— 83,554 tons
         1892-319,482 tons
         1893-179,028 tons
                                                   1910-1,333,006 tons
         1894—203,152 tons
                            Total, Tons .....25,385,930
Analysis:
              The average of all cargo analysis for 1910 is as fol-
              Dried at 212° F.
     lows:
  Aurora:
     Iron
              Phos.
                       Silica
                                Mang.
                                         Alum.
                                                  Lime Magnes. Sulph.
                                                                               Loss
     61.48
              .035
                        6.25
                                  .36
  Norrie:
     Iron
              Phos.
                       Silica
                                Mang.
                                         Alum.
                                                  Lime Magnes.
                                                                    Sulph.
                                                                               Loss
    61.63
               .034
                        5.98
                                  .36
  Nordale:
              Phos.
                       Silica
     Iron
                                Mang.
                                         Alum.
                                                  Lime Magnes.
                                                                     Sulph.
                                                                               Loss
     56.26
              .044
                      11.65
                                  .33
  Vaughn:
    Iron
61.35
              Phos.
                       Silica
                                Mang.
                                         Alum.
                                                  Lime Magnes.
                                                                    Sulph.
                                                                               Loss
              .033
                       6.24
                                 .36
  Norden:
              Phos.
                       Silica
                                         Alum.
                                                  Lime Magnes. Sulph.
    Iron
                                Mang.
                                                                               Loss
    61.57
              .088
                       6.90
                                  .37
     The Ore in its natural state is as follows:
  Aurora:
    Moist
             Iron
                    Phos.
                           Silica
     11.39
            54.48
                     .031
                             5.54
  Norrie:
    Moist
                    Phos.
                           Silica
             Iron
              54.82
     11.06
                      .030
                              5.32
  Nordale:
    Moist
             Iron
                    Phos.
                            Silica
     11.06
            50.04
                     .039
                            10.36
  Vaughn:
    Moist
                            Silica
             Iron
                    Phos.
     11.81
             54.11
                     .029
                             5.51
  Norden:
    Moist
                    Phos.
                           Silica
            Iron
            54.41
     11.63
                     .077
                             6.10
```

# OTTAWA MINE (formerly Odanah Mine).

Location: Iron County, Wisconsin, Section 27, Township 46, Range 2.

Description: First opened up in 1886. This mine ships three ores, OTTAWA and OTTAWA MANGANESE, soft, red, granular Bessemer Hematite; and ONTARIO, soft, red, granular, Non-Bessemer Hematite. Stoping system of mining is used. The greatest vertical depth is 632 feet. The ore is shipped via the Milwaukee, St. Paul & Sault Ste. Marie and the Chicago & Northwestern Railways to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

```
1886-
       13,714 tons
                                          1899-
       30,475 tons
1887
                                          1900-
1888
         5,412 tons
                                          1901-
1889-
       13,354 tons
                                          -1902
                                                  26,141 tons
1890-
         1,065 tons
                                          1903-
                                                  87,929 tons
1891
                                          1904
                                                - 30,420 tons
                                                  21,986 tons
1892
                                          1905
         6,711 tons
                                                - 57,219 tons
1893
         3,956 tons
                                          1906-
                                                - 46,424 tons
1894
         2,437 tons
                                          1907-
1895
                                          1908
                                                - 33,893 tons
1896
                                          1909—100,223 tons
1897-
                                          1910- 83,389 tons
1898-
```

Total, Tons ......564,748

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Ottawa:

53.79

Phos. Sulph. Iron Silica Magnes. Mang. Alum. Lime Loss 55.99 .052 8.82 3.37 1.01 .27 .25 .011 5.06 Ottawa Manganese: Mang.

Alum.

Lime

.18

Magnes.

.32

Sulph.

.009

Loss

5.66

Iron Phos. Silica

.055

1.06 Ontario: Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 2.36 1.17 .24 .19 5.18 56.30 .068 9.67 .008

The Ore in its natural state is as follows:

5.69

Ottawa:

Phos. Silica Moist Iron 8.74 51.10 .047 8.05

Ottawa Manganese:

Moist Iron Phos. Silica Mang. 8.50 49.22 .050 8.01 5.21

8.75

Ontario:

Moist Iron Phos. Silica 8.87 8.30 51.63 .062

# PURITAN MINE (formerly Ruby Mine).

Location: Gogebic County, Michigan, Section 17, Township 47, Range 46.

Description: First opened up in 1886. The ore is a dark reddish brown, hard and soft, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,264 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

```
1886— 16,388 tons
1887— 45,000 tons
1888— 3,058 tons
1889— 9,472 tons
                                                    1899
                                                    1900-
                                                    1901-21,788 tons
                                                   1902-
1890— 11,694 tons
                                                    1903
1891-
             913 tons
                                                    1904
                                                              1,259 tons
1892-
                                                    1905
1893-
                                                    1906
1894
                                                    1907
1895
                                                    1908-
1896
                                                    1909
1897-
                                                   1910--- 50,019 tons
1898---
```

Total, Tons ......159,591

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos, Silica Mang. Alum. Lime Magnes. Sulph. Loss 62.76 .048 5.03 .62

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.02 54.59 .042 4.37

### SUNDAY LAKE MINE.

Location: Gogebic County, Michigan, Section 10, Township 47, Range 45 West.

Description: First opened up in 1885. The mine ships two ores, SUNDAY LAKE, a Bessemer Hematite; and EARL, a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,020 feet.

The ore is shipped via the Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports. Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1885— 1,405	tons			1898—
1886— 10,963	tons			1899— 12,526 tons
1887— 18,137	tons			1900— 74,097 tons
1888—				1901— 89,997 tons
1889				1902—144,630 tons
1890— 6,010	tons			1903— 91,383 tons
1891— 64,902	tons			1904— 50,625 tons
1892— 56,046	tons			1905— 79,209 tons
1893— 22,876	tons			1906— 86,879 tons
1894— 34,323	tons			1907—101,899 tons
1895— 20,970	tons			1908—111,130 tons
1896— 89,441	tons			1909— 93,712 tons
1897— 45,815	tons			1910—115,486 tons
		Total,	Tons	1,422,461

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Sunday Lake:

Phos. Lime Magnes. Sulph. Iron Silica Mang. Alum. Loss 59.70 .025 12.25 .45 .86 .21 .007 .54 .19

Earl:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.00 .085 12.70 .48 .84 .38 .009 .70

The Ore in its natural state is as follows:

Sunday Lake:

Moist Iron Phos. Silica 9.00 54.33 .023 11.15

Earl:

Moist Iron Phos. Silica 7.00 54.87 .079 11.81

### TILDEN MINE.

Location: Gogebic County, Michigan, Section 15, Township 47, Range 46.

Description: First opened up in 1891. Four ores are shipped from this mine: TILDEN and RAND, both dark, reddish brown hard and soft, Bessemer Hematite; and NORDEN and NORDEN No. 2, both hard and soft, dark, reddish brown, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,406 feet. The ore is shipped via the Milwaukee, St. Paul and Sault Ste. Marie and Wisconsin Central Railways to Ashland, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1891— 28,415	tons		1901—446,670	tons
1892—233,356	tons		1902—468,672	tons
1893—135,118	tons		1903—211,534	tons
1894—209,077	tons .		1904—204,581	tons
1895—418,188	tons		1905—188,104	tons
1896—250,205	tons		1906—169,697	tons
1897276,890	tons		1907—312,496	tons
1898—287,203	tons		1908-111,184	tons
1899—500,830	tons		1909—154,506	tons
1900—481,909			1910— 99,937	tons
	Total	Tone	5 188 572	

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Tilden:
Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 63.10 .044 3.96 .70

Rand:
Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.79 .042 9.27 1.77

o. 2: Phos.	Silio		.55					
	Silio	- 3/						
.094	10.0		lang. .63	Alum.	Lime	Magnes.	Sulph.	Loss
re in	its na	itural	state	is as	follows	:		
		Silica 3.54						
	701	C'41						
1ron 48.84	.036	5111ca 7.98						
							•	
		Silica 3.70						
0. 2:								
Iron 51.28	Phos083	Silica 8.84						
	Iron 56.36 Iron 48.84 Iron 54.27 o. 2: Iron	re in its na Iron Phos. 56.36 .039 Iron Phos. 48.84 .036 Iron Phos. 54.27 .104 o. 2: Iron Phos.	re in its natural  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2:  Iron Phos. Silica	re in its natural state  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2: Iron Phos. Silica	re in its natural state is as  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2: Iron Phos. Silica	re in its natural state is as follows  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2: Iron Phos. Silica	re in its natural state is as follows:  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2: Iron Phos. Silica	re in its natural state is as follows:  Iron Phos. Silica 56.36 .039 3.54  Iron Phos. Silica 48.84 .036 7.98  Iron Phos. Silica 54.27 .104 3.70  o. 2: Iron Phos. Silica

# YALE MINE (formerly West Colby Mine).

Location: Gogebic County, Michigan, Section 16, Township 47, Range 46.

Description: First opened up in 1901. The mine ships five ores, YALE, WOOLSEY and PORTER, all soft, red, Bessemer Hematite; and GLYUNA and HADLEY, both soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 1,780 feet. The ore is shipped via Chicago & Northwestern Railway to Ashland, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

# Yearly Shipments:

1901— 12,836 tons	1906— 56,657 tons
1902— 26,043 tons	1907— 38,010 tons
1903— 46,211 tons	1908— 14,874 tons
1904— 46,860 tons	1909— 71,458 tons
1905— 60,224 tons	1910—108,253 tons
Total, Tons	

## **VERMILLION RANGE**

#### CHANDLER MINE.

Location: St. Louis County, Minnesota, Section 28, Township 63, Range 12.

Description: First opened up in 1888. Two ores were shipped from this mine, CHANDLER, a Bessemer Hematite; and LONG LAKE, a Non-Bessemer Hematite. Underground system of mining was used. Greatest vertical depth 900 feet. The ore was shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat.

This mine was abandoned March 11th, 1909, after 20 years' operation in which it yielded nearly 10,000,000 tons of ore.

Yearly Shipments:

wiiipiiiciico.				
1888-454,612	tons		1899—808,359	tons
1889—306,220			1900644,801	tons
1890—336,002	tons		1901—627,379	tons
1891—373,969			1902—645,786	tons
1892—651,655			1903—460,548	
1893—435,930			1904-422,162	
1894—558,050			1905—365,739	
1895—605,024			1906—318,990	
1896-471,545			1907—245,684	
1897—438,365			1908— 50,639	tons
1898—715,919			1909	
	T-4-1	Т	O E27 270	

Total, Tons ......9,537,378

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

#### Chandler Ore:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 61.30 .048 7.53 .14

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 5.36 58.01 .046 7.12

### PIONEER MINE.

Location: St. Louis County, Minnesota, Section 27, Township 63, Range 12.

Description: First opened up in 1889. The ore is a hard, red brown, Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,261 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors, and from there to the lower lake ports by boat.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1889— 3,144 tons		1900-450,794 tons
1890— 12,012 tons	,	1901—678,310 tons
1891— 3,079 tons		1902—673,836 tons
1892— 2,651 tons		1903—596,735 tons
1893—		1904—505,432 tons
1894—		1905—653,682 tons
1895— 40,054 tons		1906—766,853 tons
1896—149,073 tons		1907—830,700 tons
1897—204,103 tons		1908—477,506 tons
1898—123,183 tons		1909—477,226 tons
1899—339,897 tons		1910—526,435 tons
Total	Tone	7 517 732

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 63.35 .037 5.04 .10

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 5.18 60.07 .035 4.78

### SAVOY MINE.

Location: St. Louis County, Minnesota, Section 26, Township 63, Range 12.

Description: First opened up in 1899. This mine ships Savoy Jura, a hard and soft, red brown, Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 857 feet. The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

## Yearly Shipments:

1899— 81,022	tons		1905— 91,7 <b>7</b> 5	tons
1900—170,446			1906—106,933	
1901—212,008	tons		1907— 43,320	tons
1902—243,937	tons		1908— 82,521	tons
1903169,616	tons		1909— 83,167	tons
1904 74,866	tons		1910— 59,875	tons
	Total,	Tons	1,419,486	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 63.60 .038 4.99 .10

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 5.40 60.16 .036 4.72

#### SECTION 30 MINE.

Location: Lake County, Minnesota, Section 30, Lots 3, 5 and 6 S. E. 1/4 of N. W. 1/4, Township 63, Range 11 West.

**Description:** First opened up in 1908. Medium hard, brownish, red, Non-Bessemer, Hematite ore.

It is an underground mine. Greatest vertical depth 635 feet. The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat.

Sales Agents: Pickands, Mather & Co., Cleveland, O..

Yearly Shipments:

1910--- 51,650 tons

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss .045 63.10 6.49 .12 1.52 .24 .0081.04 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 5.60 59.57 .042 6.13

### SIBLEY MINE.

Location: St. Louis County, Minnesota, Sections 26 and 27, Township 63, Range 12.

Description: First opened up in 1899. Two ores are shipped from this mine, SIBLEY, a hard and soft, blue Bessemer Hematite; and SIBLEY JURA, a hard and soft, red brown Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,281 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1899— 5,169	tons		1905—251,170 tons
1900— 4,670			1906—271,496 tons
1901			1907—226,835 tons
1902— 78,304	tons		1908—127,544 tons
1903—113,595			1909—151,009 tons
1904—122,783	tons		1910—206,386 tons
	Total.	Tons	1,558,961

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Savoy Group:
Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 64.64 .042 3.95 .09

Jura Grade: 61.36 .040 5.07 3.75 Silica Mang. Alum. Lime Magnes. Sulph. Iron Phos. Loss 62.21 .086 5.34 .11

The Ore in its natural state is as follows:

Savoy Group:

Moist Iron Phos. Silica 5.07 61.36 .040 3.75

Jura Grade:

Moist Iron Phos. Silica 5.20 58.98 .082 5.06

#### SOUDAN MINE.:

Location: St. Louis County, Minnesota, Sections 27, 28, 32, 33

and 34, Township 62, Range 15.

Description: First opened up in 1884. This mine ships VER-MILLION LUMP ORE, a hard, steel blue, Non-Bessemer Hematite. It is an underground mine. Greatest vertical depth 1,249 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

ompments.			
1884 62,124	tons	1898-426,040	tons
1885—225,484	tons	1899—457,732	tons
1886-304,396	tons	1900—325,020	tons
1887—394,252	tons	1901—208,284	tons
1888-457,341	tons	1902—275,168	tons
1889—535,318	tons	1903—175,114	tons
1890—532,000	tons	1904— 70,713	tons
1891—517,570	tons	1905—205,002	tons
1892—498,353		1906—146,503	tons
1893—370,303	tons	1907—102,977	
1894-390,463	tons	1908— 53,070	tons
1895-432,760	tons	1909— 74,862	tons
1896—448,707	tons	1910— 75,511	tons
1897—592.196	tons	•	

Total, Tons ......8,357,363

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 63.70 .177 6.05 .08

The Ore in its natural state is as follows:

Moist Iron Phos. Silica .94 63.10 .176 5.99

#### ZENITH MINE.

Location: St. Louis County, Minnesota, Section 27, Township 63, Range 12.

**Description:** First opened up in 1892. Three ores are shipped from this mine, ZENITH, a hard and soft, blue brown Bessemer Hematite; JURA and JURA LUMP, both blue brown Non-Bessemer Hematites.

It is an underground mine. Greatest vertical depth 1,100 feet.

The ore is shipped via the Duluth & Iron Range Railroad to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by the Oliver Iron Mining Company.

## Yearly Shipments:

```
    1892— 14,991 tons
    1902—167,205 tons

    1893— 14,388 tons
    1903—161,091 tons

    1894—
    1904— 86,557 tons

    1895—
    1905—109,818 tons

    1896— 18,765 tons
    1906—181,580 tons

    1897— 40,817 tons
    1907—235,751 tons

    1898—
    1908— 50,264 tons

    1899— 79,323 tons
    1909—321,951 tons

    1901— 60,082 tons
    1910—283,320 tons
```

Total, Tons ......1,885,992

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

#### Jura:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 62.17 .091 5.21 .11

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 5.24 58.90 .086 4.94

# MOOSE MOUNTAIN RANGE

### MOOSE MOUNTAIN MINE.

Location: Hutton Township, Province of Ontario, Canada.

Description: The mine was first opened up in 1908. The ore is hard, steel blue, Non-Bessemer Magnetite. Open pit system of mining is used, the ore is blasted, trammed on surface to crushers, where it is crushed to pass a one-inch ring, and then concentrated in an electric concentrating plant.

The ore is shipped via the Canadian Northern Ontario Railway to Key Harbor on Georgian Bay and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1908— 2,557 tons 1910— 72,470 tons 1909- 28,556 tons

Total, Tons ...........103,583

The average of all cargo analysis for 1910 is as fol-Analysis: Dried at 212° F. lows:

Phos. Silica Lime Magnes. Sulph. Loss Mang. Alum. Iron 54.83 .091 14.06 .06 1.92 3.82 3.64 .029 .63 The Ore in its natural state is as follows:

Moist Iron Phos. Silica

**.**87 54.35 .090 13.94

## **BARABOO RANGE**

### ILLINOIS MINE.

Location: Sauk County, Wisconsin, Section 15 and 16, Township 11 North, Range 5 East.

Description: First opened up in 1904. The ore is soft, red, Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 475 feet. Mine has been idle since 1908.

The ore is shipped via Chicago & Northwestern Railway to the furnace.

Owners: Illinois Iron Mining Co.

Yearly Shipments:

1907— 72,180 tons 1908— 51,108 tons

# MENOMINEE RANGE

# ANTOINE MINE (Formerly Traders).

Location: Dickinson County, Michigan, Sections 17 and 20, Township 40 North, Range 30 West.

Description: First opened up in 1895. Two ores are shipped from this mine, CLIFFORD, a hard, grayish blue, silicious Bessemer, Semi-specular Hematite; and ANTOINE, a grayish blue, silicious, Non-Bessemer Semi-Specular Hematite. Open pit milling system of mining is used. The greatest vertical depth is 135 feet. The ore is crushed to three-inch size.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway or the Chicago & Northwestern Railway to Escanaba, and from there to the lower lake ports by boat.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1895— 27,931	tons.		1903—107,886	tons
1896—110,821	tons		1904— 81,164	
1897— 98,847	tons		1905—138,395	
1898—104,510			1906—195,855	
1899— 93,025	tons		1907—100,996	tons
1900—119,940	tons		1908—	
1901— 63,429	tons		1909—	•
1902—110,993	tons		1910— 91,081	tons
•	Total.	Tons	1.444.873	

The average of all cargo analysis for 1910 is as fol-

Analysis: The average of a lows: Dried at 212° F.

Clifford:

Sulph. Iron Phos. Silica Mang. Alum. Lime Magnes. Loss 1.00 39.25 .017 41.29 .18 .92 .57 .72 .016

Antoine:

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron 1.05 38.62 .030 42.13 .15 .95 .59 .75 .017

The Ore in its natural state is as follows:

Clifford:

Moist Iron Phos. Silica 2.28 38.36 .017 40.35

Antoine:

Moist Iron Phos. Silica 1.95 37.87 .029 41.31

#### ARAGON MINE.

Location: Dickinson County, Michigan, Sections 8 and 9, Township 39, Range 29.

Description: First opened up in 1899. There are three ores shipped from this mine, the GRANADA TOWNSITE and BRIER HILL, which are soft, blue, Non-Bessemer Hematites; and CADIZ, a hard, blue, Non-Bessemer Hematite. Underground method of mining is used. The greatest vertical depth is 1,083 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

```
1889— 1,745 tons
                                                  1900-404,645 tons
                                                  1901—477,212 tons
1902—646,203 tons
1890— 46,609 tons
1891— 96,829 tons
1892—167,948 tons
                                                  1903-522,035 tons
                                                  1904-374,944 tons
1893—127,901 tons
                                                  1905-423,698 tons
1894-138,209 tons
1895—183,296 tons
1896— 95,809 tons
1897—149,594 tons
1898—295,821 tons
                                                  1906—431,000 tons
1907—441,636 tons
1908—226,354 tons
                                                  1909-246,984 tons
                                                  1910-241,046 tons
1899-337,807 tons
```

Total, Tons ......6,077,325

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Granada:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.79 .061 7.12 .16

Briar Hill:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 54.64 .054 8.09 .29

Cadiz:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Los 51.16 .054 17.03 .17

The Ore in its natural state is as follows:

Granada:

Moist Iron Phos. Silica 7.74 55.16 .057 6.57

Briar Hill:

Moist Iron Phos. Silica 5.18 51.81 .051 7.67

Cadiz:

Moist Iron Phos. Silica 7.26 47.44 .051 15.80

## ARMENIA MINE.

Location: Iron County, Michigan, Section 23, Township 43, Range 32.

**Description:** First opened up in 1889. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

# Yearly Shipments:

1889— 50,275 tons	1900—
1890— 26,649 tons	1901— 18,750 tons
1891—	1902—100,864 tons
1892—	1903— 31,901 tons
1893—	1904— 16,577 tons
1894—	1905—
1895— 2,045 tons	1906— 27,882 tons
1896—	1907— 36,665 tons
1897—	1908—
1898—	1909—
1899 •	1910— 65, <b>47</b> 3 tons
Total.	Tons 377.081

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.32 .310 8.86 .54 2.66 1.37 .80 .005 3.20

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.60 51.24 .271 7.92

#### BAKER MINE.

Location: Iron County, Michigan, Section 31, Township 43, Range 34.

Description: First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

# Yearly Shipments:

```
1909—45,003 tons 1910—39,417 tons
Total, Tons ......84,420
```

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 56.64
 .348
 7.67
 .51
 1.60
 1.93
 1.20
 .008
 4.70

The Ore in its natural state is as follows: Moist Iron Phos. Silica

8.75 51.68 .318 6.99

#### BALTIC MINE.

Location: Iron County, Michigan, Section 7, Township 42, Range 34 West.

**Description:** First opened up in 1901. The ore is a Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 553 feet. The ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1901— 17,326 tons 1906—186,495 tons 1907—189,119 tons 1902— 64,664 tons 1903—123,236 tons 1904—151,114 tons 1905—133,246 tons 1908-129,037 tons 1909—174,426 tons 1910—171,930 tons

Total, Tons ......1,340,593

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 7.96 4.94 55.60 .456 .32 3.11 1.57 1.49 .048

The Ore in its natural state is as follows:

Moist Iron Phos. Silica .413 9.50 50.32 7.20

#### BERKSHIRE MINE:

Location: Iron County, Michigan, Section 6, Township 42, Range 34.

**Description:** First opened up in 1908. The ore is soft, red, Non-Bessemer Hematite. The caving system of mining is used. The greatest vertical depth is 365 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1908— 3,440 tons 1910-97.999 tons 1909-34,295 tons Total, Tons ........135,734

The average of all cargo analysis for 1910 is as fol-Analysis: Dried at 212° F. lows:

Silica Mang. Iron Phos. Alum. Lime Magnes. Sulph. Loss 54.25 .720 10.25 4.52 2.43 2.60 3.05

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.44 46.97 .645 9.18

#### BREEN MINE.

Dickinson County, Michigan, Section 22, Township Location: 39, Range 28.

Description: Reopened in 1905. Waucedah ore is shipped from this mine. It is a hard, red, silicious Hematite. pit and milling system of mining is used. The greatest vertical depth is 258 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Prior to 1887-17,430 tons 1908---1905—16,625 tons 1909---1906—21,004 tons 1907—20,366 tons 1910-

Total, Tons ...........75,425

Expected analysis for season of 1911 is as follows: Analysis: Dried at 212° F.

Lime Magnes. Sulph. Phos. Silica Mang. Alum. Loss 39.00 41.53 .016 .89 .35 .60 .03 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 37.83 .016 40.28

# BRISTOL MINE (formerly Claire Mine).

Iron County, Michigan, Section 19, Township 43, Location: Range 32.

Description: First opened up in 1892. The mine ships two ores, BRISTOL and MANGANATE, both hard, brown, Non-Bessemer Hematites. The stoping system of mining is The greatest vertical depth is 900 feet. The ore is crushed to three inch size.

The ore is shipped via the Chicago & Northwestern Railway and the Chicago, Milwaukee & St. Paul Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

Diipiiio	
1892— 57,352 tons	1902—129,035 tons
1893— 9.612 tons	1903—246,581 tons
1894—	1904—132,420 tons
1895—	1905—210,388 tons
1896—	1906—298,031 tons
1897—	1907—345,676 tons
1908—	1908—190,300 tons
1909— 80,915 tons	1909—396,825 tons
1900— 51,639 tons	1910—270,742 tons
1001 36 503 tons	

Total, Tons ......2,456,109

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bristol: Mang. Iron Phos. Silica Alum. Lime Magnes. Sulph. Loss 54.86 .633 6.45 .74 2.83 2.77 1.54 5.26 .111 Manganate: Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 50.36 .593 6.90 3.21 3.60 2.17 2.41 7.72 .055 The Ore in its natural state is as follows: Bristol: Moist Iron Phos. Silica 7.80 50.58 .584 5.95 Manganate: Moist Iron Phos. Silica 46.52 .548 6.37 7.63

#### BUCKEYE MINE.

Florence County, Wisconsin, Section 9, Township 39, Location:

Range 19.

**Description:** First opened up in 1909. The ore is a lumpy, red, Non-Bessemer Hematite. Underground system of mining is The greatest vertical depth is 300 feet. The ore is passed over a grizzly and the lumps are sledged. The ore is shipped via the Chicago & Northwestern Railway

to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1910— 89,116 tons

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows:

Phos. Mang. Iron Silica Alum. Lime Magnes. Sulph. 52.40 2.22 2.51 6.50 .436 10.75 .13 2.75 .196 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 48.21 .401

## CALUMET MINE.

Dickinson County, Michigan, Section 8, Township 41, Location: Range 23 West.

Reopened in 1906. The ore is a silicious Hematite. Description: Underground system of mining is used. The greatest vertical depth is 215 feet. The ore is crushed.

The ore is shipped via the C. & N. W. Railway to Escanaba,

and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Prior to 1894— 38,713 1908— 15,222 tons 1909— 1906— 15,773 tons 1907— 51,646 tons Total, Tons ......121,354

Expected analysis for season of 1911 is as follows: Analysis: Dried at 212° F.

Silica Iron Phos. Mang. Alum. Lime Magnes. Sulph. Loss 41.75 .023 34.67 2.23 1.46 .20 .72 .96 .009

The Ore in its natural state is as follows:

Moist Iron Phos. Silica
4.50 39.87 .022 33.11

#### CASPIAN MINE.

Location: Iron County, Michigan, Section 1, Township 42, Range 35 West.

**Description:** The mine was first opened up in 1903. This mine ships BALTIC ore, which is a Non-Bessemer Hematite. Underground method of mining is used. The greatest vertical depth is 292 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports,

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1903—	2,088	tons		1907—138,867	tons
1904	4,242	tons		1908—102,628	tons
1905—	10,248	tons		1909—189,023	tons
1906	80,875	tons		1910—171,334	tons
	•	Total	Toma	600.305	

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 55.60
 .456
 7.96
 .32
 3.11
 1.57
 1.49
 .048
 4.94

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.50 50.32 .413 7.20

# CHAPIN MINE.

Location: Dickinson County, Michigan, Sections 25 and 30, Township 40, Range 31 and 30.

Description: First opened up in 1880. Two ores are shipped from this mine, CHAPIN and AJAX, both ores are soft, blue, Non-Bessemer Hematites. It is an underground mine. The greatest vertical depth is 1,522 feet.

The ore is shipped via the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern Railways to Escanaba, and from there by boat to the lower lake ports.

This mine is operated by the Oliver Iron Mining Co.

### Yearly Shipments:

1880- 34,556	tons	1889—518,990	
1881—134,521	tons	1890—742,843	
1882—247,506	tons	1891—488,749	
1883—265,830		1892—660,052	
1884—290,972		1893—489,134	
1885—157,455		1894—235,895	
1886—198,871		1895—618,589	
1887—336,128		1896—420,318	
1888—290,871	tons	1897—643,402	tons

1905—902,628 tons 1906—943,425 tons 1907—855,308 tons 1898—724,768 tons 1899—940,513 tons 1900-929,937 tons 1901-929,701 tons 1908-391,620 tons 1909-587,647 tons 1902-956,812 tons 1903-704,051 tons 1910—465,543 tons 1904—541,324 tons Total, Tons ......17,649,477

The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Chapin:

Silica 6.44 Iron Phos. Mang. Alum. Lime Magnes. Sulph. Loss 57.97 .065 .35

Ajax:

Silica Iron Phos. Mang. Alum. Lime Magnes. Sulph. Loss .055 14.70 51.73

The Ore in its natural state is as follows:

Chapin:

Moist Phos. Silica Mang. Iron 7.16 53.82 .060 5.98

Ajax:

Moist Phos. Silica Mang. Iron 6.83 48.20 .052 13.69 .31

#### CHATHAM MINE.

Location: Iron County, Michigan, Section 35, Township 43, Range 35.

Description: First opened up in 1907. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is The greatest vertical depth is 500 feet. The ore is passed over a grizzly and the lumps are sledged. The ore is shipped via the Chicago & Northwestern Railway

to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

1909— 68,730 tons 1910— 51,988 tons 1907— 14,833 tons 1908— 45,826 tons Total, Tons ......181,427

Analysis: The average of all cargo analysis for 1910 is as fol-

Dried at 212° F. lows:

Phos. Mang. Alum. Lime Magnes. Sulph. Loss Iron Silica 1.39 .82 .98 6.47 53.94 .328 11.12 .18 2.00 The Ore in its natural state is as follows:

Iron 50.84 Phos. Silica Moist 5.74 .309 10.48

#### CRYSTAL FALLS MINE.

Iron County, Michigan, Section 21, Township 43, Location: Range 32.

Description: First opened up in 1882. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway and the Chicago, Milwaukee & St. Paul Railway to Escanaba, and from there by boat to the lower lake ports.

Yearly Shipments:

```
Prior to 1895—5,315 tons
1895—13,037 tons
1896—44,526 tons
1897—95,210 tons
1898—128,233 tons
1898—128,233 tons
1899—147,346 tons
1900—197,770 tons
1901—230,614 tons
1902—195,555 tons
```

Total, Tons ......1,735,251

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.70 .616 7.60 .69 1.73 2.35 1.90 .006 3.40 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.68 51.78 .562 6.94

## CYCLOPS AND NORWAY MINE.

Location: Dickinson County, Michigan, Section 5, Township 39, Range 29.

Description: First opened up in 1878. The mine ships five ores, the CYCLOPS and VULCAN are medium hard, blue and brown, Bessemer, red Hematites; HARPER, a medium hard, blue and brown, Non-Bessemer red Hematite; JUPITER, a medium hard, blue and brown, silicious Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The open pit, milling and underhand caving systems of mining are used. The greatest vertical depth is 355 feet.

The ore is shipped via the Chicago & Northwestern and Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Owners: Penn. Iron Mining Co.

# Yearly Shipments:

Cyclops	1885— 49,897 tons
1878— 6,275 tons	1886— 37,189 tons
1879— 46,472 tons	1887— 14,297 tons
1880— 14,368 tons	1888— 14,693 tons
1881— 12,214 tons	1889— 6,101 tons
1882— 18,287 tons	1890— 7,361 tons
1883— 22,675 tons	1891— 10,599 tons
1884— 24,099 tons	1892— 1,697 tons
Total, Tons	286.093

```
Norway
1878— 7,533 tons
1879— 73,590 tons
                                                   1885— 67,741 tons
                                                         — 93,878 tons
— 95,726 tons
                                                   1886-
                                                   1887-
         1880—198,165 tons
1881—137,558 tons
                                                   1888-
                                                          - 87,260 tons
                                                   1889-
                                                         - 68,044 tons
         1882—165,084 tons
                                                   1890-
                                                          - 61,717 tons
                                                   1891
         1883—114,836 tons
                                                            4,089 tons
         1884-- 71,515 tons
                                                   1892-
                                                         – 44,767 tons
                          Total, Tons ......1,291,352
Penn Iron Mining Co.
          1893-280,450 tons
                                                   1902—273,443 tons
          1894
               -175,274 tons
                                                    1903—343,543 tons
          1895-
                                                   1904-141,948 tons
               -290,622 tons
                                                   1905-423,244 tons
          1896
                -179,917 tons
          1897-
                -237,886 tons
                                                    1906-496,582 tons
               -223,713 tons
                                                    1907-381,128 tons
          1898-
          1899-
               -229,651 tons
                                                    1908—176,211 tons
          1900-197,606 tons
                                                    1909-428,004 tons
                                                    1910-344,760 tons
          1901-538,126 tons
                          Total, Tons......8,845,135
Analysis:
               The average of all cargo analysis for 1910 is as fol-
     lows:
              Dried at 212° F.
   Cyclops:
     Iron
              Phos.
                                                                     Sulph.
                                                                              Loss
                       Silica
                                         Alum.
                                                  Lime
                                                          Magnes.
                                Mang.
                                                                      .048
     60.35
               .015
                        9.77
                                  .07
                                          2.16
                                                     .81
                                                             1.26
   Vulcan:
              Phos.
                       Silica
                                         Alum.
                                                   Lime
                                                          Magnes.
                                                                     Sulph.
                                                                               Loss
     Iron
                                Mang.
     58.38
               .055
                       11.72
                                  .01
                                          2.30
                                                     .76
                                                             1.57
                                                                      .054
   Jupiter:
     Iron
              Phos.
                       Silica
                                Mang.
                                         Alum.
                                                   Lime
                                                          Magnes.
                                                                     Sulph.
                                                                               Loss
     41.81
               .017
                       33.32
                                          2.95
                                                     .69
                                                              .88
                                                                      .050
   Harper:
               Phos.
                        Silica
                                Mang.
                                          Alum.
                                                    Lime
                                                           Magnes.
                                                                       Sulp.
                                                                               Loss
      Iron
                                                                               2.05
      59.95
               .100
                        7.33
                                  .11
                                          1.38
                                                    1.13
                                                             2.27
                                                                      .033
      The Ore in its natural state is as follows:
   Cyclops:
      Moist
              Iron
                     Phos.
                            Silica
                              9.05
       7.37
              56.11
                       .014
   Vulcan:
      Moist
              Iron
                     Phos.
                            Silica
       7.58
              54.68
                      .051
                             10.83
   Jupiter:
                     Phos.
                            Silica
      Moist
              Iron
              39.52
                             31.35
       5.92
                      .016
   Harper:
      Moist
                     Phos.
                             Silica
              Iron
                             6.91
       5.70
              56.53
                      .094
```

### DAVIDSON NO. 1 MINE.

Location: Iron County, Michigan, Section N. E. 1/4-N. W. 1/4 23, Township 43, Range 35.

Description: This mine will be opened up in 1911. The ore is Non-Bessemer Hematite. The greatest vertical depth is 450 feet.

The ore will be shipped via the Chicago & Northern Railway to Escanaba, and from there by boat to the lower lake ports.

Owners: Davidson Ore Mining Co.

Expected Analysis for 1911:

Iron 56.90	Phos595	. Silio 2.8	ca Man	g. Alum. 2.78	Lime .45	Magnes. .40	
	Iron 52.63						

## DAVIDSON NO. 2 MINE.

Location: Iron County, Michigan, W. ½ S. E. ¼ Section 14,

Township 43, Range 35.

Description: This mine will be opened up in 1911. The ore is a Non-Bessemer Hematite. The greatest vertical depth is 150 feet.

The ore will be shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Owners: Davidson Ore Mining Co.

#### DUNN MINE.

Location: Iron County, Michigan, Section 1, Township 42, Range 33.

**Description:** First opened up in 1887. The ore is soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1887— 24,677	tons		1899— 7,458 tons
1888—118,096	tons		1900
1889—151,828	tons		1901—
1890—156,963			1902— 2,816 tons
1891—162,721			1903— 5,365 tons
1892—133,666	tons		1904—
1893— 58,590	tons		1905— 21,051 tons
1894— 24,538	tons		1906— 91,476 tons
1895— 90,885	tons		1907—141,992 tons
1896— 47,081			1908— 8,829 tons
1897— 31,062			1909—193,396 tons
1898— 49,381	tons		1910—136,144 tons
	Total.	Tons	1.658.015

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 57.10
 .590
 6.47
 .70
 1.91
 2.58
 2.10
 .007
 3.05

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.15 52.45 .542 5.94

# EAST VULCAN MINE.

Location: Dickinson County, Michigan. Sections 10 and 11, Township 39, Range 29.

Description: First opened up in 1877. Five ores are shipped from this mine, CYCLOPS and VULCAN, medium hard, blue and brown Bessemer, red Hematite; HARPER, medium hard, blue and brown, Non-Bessemer, red Hematite; JUPITER, medium hard, blue and brown, silicious Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The mine is worked by rooms and pillars with square set timbering, by the caving and underhand stoping systems. The greatest vertical depth is 1,400 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Owners: Penn Iron Mining Co.

See Cyclops and Norway Mines for Analysis.

Yearly Shipments:

1877— 4,593 tons	1887—205,036 tons
1878— 31,129 tons	1888—129,541 tons
1879— 57,350 tons	1889—153,900 tons
1880— 72,405 tons	1890—104,996 tons
1881— 85,671 tons	1891— 78,967 tons
1882— 94,042 tons	1892—179,904 tons
1883— 79,874 tons	A fam 1902 ahin ann anns an
1884—101,722 tons	After 1892 this ore was re-
1885—124,120 tons	ported under shipments
1886—143,930 tons	from Penn Iron Mining Co.
	ons1,668,654

## FAIRBANKS MINE, OR PAINT RIVER MINE.

Location: Iron County, Michigan, Section 20, Township 43, Range 32.

Description: First opened up in 1882. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

```
Sales Agents: Corrigan, McKinney & Co., Cleveland.
Yearly Shipments:
          1882-
                - 6,515 tons
          1883— 5,873 tons
                                                    1898-
                                                   1899-
          1884— 11,652 tons
         1885— 2,373 tons
1886— 13,933 tons
                                                    1900-
                                                            1,316 tons
                                                    1901
          1887— 10,240 tons
                                                    1902-

    10,383 tons

         1888— 12,506 tons
1889— 32,700 tons
                                                    1903
                                                            9,863 tons
                                                   1904
                                                         - 11,257 tons
                                                   1905— 11,973 tons
1906— 28,321 tons
         1890— 62,654 tons
1891— 45,435 tons
1892— 18,390 tons
                                                    1907— 75,805 tons
          1893-
                                                    1908-
                                                    1909-
          1894
          1895-
                                                    1910-
          1896---
                          Total, Tons .......379,789
              Expected analysis for season of 1911 is as follows:
     Dried at 212° F.
              Phos.
                                         Alum.
                                                  Lime Magnes. Sulph.
                                                                               Loss
     Iron
                       Silica
                                Mang.
                                                   2.25
                                                             1.95
                                                                               3.70
     56.85
               5.80
                        6.93
                                  .85
                                          1.87
                                                                      .009
     The Ore in its natural state is as follows:
     Moist
             Iron Phos. Silica
      9.55
             51.42
                      .524
```

### FLORENCE MINE.

Location: Florence County, Wisconsin, Sections 20 and 21, Township 40, Range 18.

Description: First opened up in 1880. The ore is a medium hard, red and brown, Non-Bessemer Hematite. Milling and stoping systems of mining are used. The greatest vertical depth is 700 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland. Yearly Shipments:

Shipments:			
1880— 14,143	tons		1896— 35,136 tons
1881—100,501	tons		1897— 37,594 tons
1882—160,155	tons		1898— 93,663 tons
1883— 40,232	tons		1899— 74,235 tons
1884—			1900— 35,756 tons
1885			1901— 15,395 tons
1886— 8,210	tons		1902—130,798 tons
1887— 79,399			1903— 95,877 tons
1888—142,585	tons		1904—153,452 tons
1889—196,269	tons		1905—233,858 tons
1890—218,570	tons		1906—169,459 tons
1891— 48,806			1907—178,955 tons
1892— 48,246	tons		1908—140,354 tons
1893— 9,634	tons		1909—231,191 tons
1894— 2,726	tons		1910239,161 tons
1895— 22,820	tons		
	Total,	Tons	2,957,180

Analysis: The average of all cargo analysis for 1910 is as fol-

Dried at 212° F. lows:

Lime Magnes. 2.14 3.01 Iron Phos. Silica Mang. Alum. Sulph. Loss 54.80 .269 6.43 .18 3.91 1.85 4.77

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.02 49.31 .242 5.79

#### FOGARTY MINE.

Iron County, Michigan, Section 1, Township 42, Location: Range 35 West.

**Description:** First opened up in 1907. BALTIC ore, which is a Non-Bessemer Hematite, is shipped from this mine. Underground system of mining is used. The greatest vertical depth is 255 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907— 7.949 tons 1909— 77,356 tons 1910— 51,071 tons 1908— 32,560 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

Dried at 212° F. lows:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. 55.60 4.94 .456 7.96 .32 3.11 1.57 1.49 .048

The Ore in its natural state is as follows:

Phos. Silica Moist Iron 9.50 50.32 .413 7.20

#### GENESEE MINE.

Location: Iron County, Michigan, Section 29-30-31, Township 43, Range 32 West.

Description: First opened up in 1902. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1902— 14,455 tons 1903— 61,694 tons 1904—132,380 tons 1905— 77,370 tons 1906— 80,971 tons 1907--- 38,984 tons 1908---1909— 65,585 tons 1910— 66,185 tons

Total, Tons ......537,624

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Lime Magnes. Sulph. Loss Alum. **57.08** .587 2.63 **2**.55 .008 2.88 7.33 2.12

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.65 52.14 .536 6.70

### GREAT WESTERN MINE.

Location: Iron County, Michigan, Section 21, Township 43, Range 32.

Description: First opened up in 1882. Two ores are shipped from this mine, GREAT WESTERN and BASIC, both soft, brown, Non-Bessemer Hematite. The ore is crushed. Underground system of mining is used.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1897-1882— 587 tons 1883— 22,825 tons 1898-— 33,851 tons 1899— 43,316 tons 1900— 98,550 tons 1884— 20,710 tons 1885-1886— 22,267 tons 1901—123,261 tons 1887— 23,239 tons 1902-- 42,470 tons 1888— 21,860 tons 1889— 38,454 tons 1890— 72,546 tons 1903-100,751 tons 1904— 68,318 tons 1905—191,265 tons 1891- 62,464 tons 1906-311,218 tons 1907-234,492 tons 1892— 87,487 tons 1893-661 tons 1908-124,246 tons 1894 1909-112,747 tons 1895---1910- 80,709 tons 1896— 14,643 tons

Total, Tons ......1,952,937

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Great Western:

Silica Alum. Magnes. Sulph. Loss Iron Phos. Mang. Lime .74 3.16 55.00 .517 6.89 2.90 2.98 2.12 .043 Basic: Magnes. Loss Phos. Silica Mang. Alum. Lime Sulph. 50.50 .420 .42 4.80 2.57 3.64 2.93 .091 6.12 The Ore in its natural state is as follows:

Great Western:

Moist Iron Phos. Silica 8.35 50.41 .474 6.31

Basic:

Moist Iron Phos. Silica 8.35 46.28 .385 5.61

### GROVELAND MINE.

Location: Dickinson County, Michigan, N. E. 1/4 of S. E. 1/4 and N. E. 1/4 of S. W. 1/4, Section 31, Township 42, Range 29. Description: First opened up in 1901. The ore is hard, grey,

Description: First opened up in 1901. The ore is hard, grey, low grade Bessemer Hematite. Milling, overhead and underhand stoping systems of mining are used. The greatest vertical depth is 186 feet. The ore was crushed in 1910. The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Company, Cleveland.

Yearly Shipments:

Prior to 1901—1,049 tons	1906—
1901— 11,444 tons	1907— 13,913 tons
1902— 7.599 tons	1908— 9,123 tons
1903— 1,294 tons	1909— 24,933 tons
1904— 4.737 tons	1910— 26,462 tons
1905—	

Total, Tons ........100,554

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 46,35 .039 19.54 1.04 2.06 2.81 3.86 .011 3.86

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 2.56 45.16 .038 19.04

#### HEMLOCK MINE.

Location: Iron County, Michigan, Section 4, Township 44, Range 33 West.

Description: First opened up in 1889. The ore is Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 935 feet. The ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

### Yearly Shipments:

1889			1900— 72,413 t	ons
1890—			1901—149,966 t	ons
1891— 35,531	tons		1902—123,331 t	
1892— 65,459	tons		1903— 79,420 t	
1893— 11,323	tons		1904—136,232 t	
1894—			1905—124,450 t	
1895— 949			1906—106,437 t	
1896— 94,645			1907—117,181 t	
1897— 96,032	tons		1908— 83,834 t	
1898— 69,865	tons		1909—112,481 t	
1899—110,269			1910—115,407 t	ons
	Total.	Tons	1,705,225	

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 52.50 .196 4.42 .40 2.53 5.64 3.68 .016 7.69

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 2.80 51.03 .191 4.30

## HIAWATHA MINE.

Location: Iron County, Michigan, Section 35, Township 43 North, Range 35 West.

Description: First opened up in 1893. The ore is medium hard, red, Non-Bessemer Hematite. The sub-level stoping system of mining is used. The greatest vertical depth is 665 feet. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Rogers, Brown Iron Co., Buffalo, N. Y.

Yearly Shipments:

1893— 1,683	tons		1902— 74,596 tons
1894			1903— 53,828 tons
1895— 1,201	tons		1904— 38,288 tons
1896			1905— 9,704 tons
1897—			1906— 20 tons
1898			190 <b>7.</b>
1899—			1908—138,190 tons
1900 11,008	tons		1909—136,739 tons
1901— 20,355	tons		1910—128,884 tons
ŕ	Total,	Tons	614,496

#### HOLLISTER MINE.

Location: Iron County, Michigan, Section 13, Township 43, Range 33 West.

**Description:** First opened up in 1890. The ore is soft, red, Non-Bessemer Hematite. Stoping system of mining is used. The greatest vertical depth is 500 feet.

greatest vertical depth is 500 feet. The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Hollister Mining Co.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

 1890—
 2,020 tons
 1907—
 6,371 tons

 1891—
 1,057 tons
 1908—
 10,671 tons

 1892—
 1,021 tons
 1909—
 25,842 tons

 1893-1906—
 1910—
 49,434 tons

Total, Tons ........96,416

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 54.50
 1.021
 11.00
 1.12
 1.53
 4.36
 .38
 .039
 1.02

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 6.00 51.23 .960 10.34

# KASECO MINE (Formerly Konwinski).

Location: Iron County, Michigan, Section 23, Township 43, Range 35.

Description: First opened up in 1906. The mine ships JAMES ore, a soft, yellow, Non-Bessemer Hematite. Sub-level caving system of mining is used. The greatest vertical depth is 301 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1910— 78,388 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 55.50
 .488
 8.73
 .22
 1.13
 .46
 .22
 .017
 8.72

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.00 51.06 .449 8.03

## KIMBALL MINE.

Location: Iron County, Michigan, Section 29, Township 43, Range 32.

Description: First opened up in 1906. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1907— 16,224 tons

1909— 1910—

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss .610 2.25 55.95 8.56 .65 2.63 2.15 .006 2.95

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.40 51.25 .556 7.84

### LAMONT MINE.

Location: Iron County, Michigan, Section 20, Township 43, Range 32.

**Description:** First opened up in 1889. The ore is a soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Yearly Shipments:

1889— 12,348 tons	1900— 31,323 tons
1890— 31,139 tons	1901—
1891— 26,226 tons	1902— 47,267 tons
1892— 42,819 tons	1903— 43,736 tons
1893— 13,777 tons	1904— 29,393 tons
1894— 2,600 tons	1905— 74,991 tons
1895—	1906— 89,980 tons
1896	1907— 42,090 tons
1897—	1908—
1898—	1909
1899— 67.652 tons	1910— 3,183 tons
Total,	Tons558,524

# LINCOLN MINE.

Location: Iron County, Michigan, Section 21, Township 43, Range 32 West.

Description: First opened up in 1891. The ore is a soft, brown, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

```
1903— 15,606 tons
1904— 17,577 tons
1891---
         1,813 tons
     - 26,019 tons
1892-
1893-
         8,757 tons
                                           1905-
                                                  - 19,539 tons
1894-1898-
                                                     5,890 tons
                                           1906—
1899-43,622 tons
                                           1907-
                                                       714 tons
1900— 72,959 tons
1901— 19,727 tons
                                           1908-
                                           1909-
                                                     1,657 tons
1902-- 7,747 tons
                                           1910-
                Total, Tons ......241,627
```

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.76 .469 6.20 .77 2.83 2.33 2.37 .009 3.14

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.56 51.90 .429 5.67

### LORETTO MINE.

Location: Dickinson County, Michigan, Section 7, Township 39, Range 28.

Description: First opened up in 1892. Three ores are shipped from this mine, RUSSELL and RUSSELL SPECIAL, soft, blue, Non-Bessemer Hematite; and SAN JOSE, a soft, blue, Bessemer Hematite. Top slicing system of mining is used. Greatest vertical depth is 800 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1893— 8,131	tons	1902—128,300 tons
1894— 55,983	tons	1903— 87,939 tons
1895— 53,160	tons	1904— 54,720 tons
1896— 34,334	tons	1905—118,738 tons
1897— 54,104	tons	1906—140,390 tons
1898— 68,447	tons	1907— 99,779 tons
1899— 64,824	tons	1908— 13,354 tons
1900— 61,219	tons	1909— 96,613 tons
1901— 54,985	tons	1910—116,048 tons
	Total, Tons	311,068

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Russell:

47.40

.059

18.02

53.04	.053	10.25	Mang. .27	2.82	2.10	Magnes. 3.85	.006	4.42
Russell S	Special:							
Tron	Phos	Silica	Mano	Alum	Lime	Magnes	Sulph	T.oss

2.63

1.35

.16

2.33

.005

3.81

The Ore in its natural state is as follows:

Russell:

Moist Iron Phos. Silica 7.40 49.12 .049 9.49

Russell Special:

Moist Iron Phos. Silica 7.40 43.89 .055 16.69

## MANSFIELD MINE.

Location: Iron County, Michigan, Section 17 and 20, Township 43, Range 31.

Description: First opened up in 1890. The mine ships CLEAR-FIELD ore, a hard, brown, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 1,189 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

ompinents.		
1890— 18,303	tons	1901— 74,113 tons
1891— 49,836	tons	1902— 31,181 tons
1892— 69,259	tons	1903— 51,440 tons
1893— 69,558	tons	1904— 79,163 tons
1894—		1905— 38,584 tons
1895		1906—
1896		1907—183,532 tons
1897— 37,182	tons	1908— 44,633 tons
1898— 60,739	tons	1909—118,713 tons
1899— 86,607	tons	1910—114,357 tons
1900 90.155	tons	

Total, Tons .....1,217.355

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Clearfield:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.19 .119 5.30 .18

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.72 51.63 .108 4.78

#### McDONALD MINE.

Location: Iron County, Michigan, S. E. 1/4 of N. E. 1/4 Section

23, Township 43, Range 32.

Description: First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Milling and caving systems of mining are used. The greatest vertical depth is 240 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and

from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Co., Cleveland.

Yearly Shipments:

1909— 1,144 tons 1910— 6,022 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss

57.00 .10 6.00 .30 2.50

## MICHIGAN MINE.

Location: Iron County, Michigan, Section 9, Township 44, Range 33.

Description: First opened up in 1893. This mine ships MICHI-GAN No. 1 ore, a hard, yellowish brown, Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 541 feet.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower

lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1893—	505 tons	1902— 53,272 t	ons.
1894	77 tons	1903—	
1895—:	1.071 tons	1904—	
1896	•	1905— 58,088 t	ons
1897	216 tons	1906— 146 t	ons
1898		1907— 39,819 t	ons
1899—		1908— 603 t	ons
1900		1909—	
1901		1910— 17,922 t	ons
	Total,	Tons171,719	

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Michigan No. 1:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 55.72 .193 10.54 .21

The Ore in its natural state is as follows:

Michigan No. 1:

Moist Iron Phos. Silica 9.00 50.71 .175 9.59

# MILLIE MINE. (Formerly Hewitt Mine).

Location: Dickinson County, Michigan, Section 31, Township 40, Range 34 West.

Description: First opened up in 1880. Two ores are shipped from this mine. ALGOMA, a soft, blue, Bessemer Hematite; and DAVY, a hard, blue, silicious Hematite. The sub-level

back stope and open cut mining systems are used. The greatest vertical depth is 600 feet. The Davy ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

```
Yearly Shipments:
```

```
1896— 21,815 tons
1897— 10,374 tons
1898— 17,430 tons
1899— 15,194 tons
1881-
           4,352 tons
          9,500 tons
7,516 tons
7,927 tons
1882-
1883---
1884
           4.627 tons
                                                   1900- 14,922 tons
1885
           5,517 tons
                                                   1901— 12,133 tons
1902— 25,935 tons
1886
1887-
           1,163 tons
1888— 11,124 tons
1889— 12,274 tons
                                                   1903-40,860 tons
                                                   1904-
      - 39,232 tons
1890-
                                                   1905
           5,889 tons
1891-
                                                   1906-
                                                          – 36,815 tons
                                                   1907- 18,691 tons
1892
           6,780 tons
                                                   1908— 3,322 tons
1893-
       - 13,062 tons
1894
                                                   1909- 10,887 tons
1895— 10,924 tons
                                                  1910—
```

Total, Tons .........368,267

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Algoma:
---------

1ron 58.60	Phos. .045	8.30	Mang.	Alum. 1.09	2.15	Magnes. 1.98	Sulph. .041	Loss 2.40
Davy: Iron 40.55	Phos027	Silica 36.25	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss 2.10

The Ore in its natural state is as follows:

# Algoma:

Moist Iron Phos. Silica 4.26 56.10 .043 7.95

## Davy:

Moist Iron Phos. Silica 1.50 39.94 .027 35.71

### MUNRO MINE.

Location: Dickinson County, Michigan. Section 6, Township 39 North, Range 29 West.

Description: First opened up in 1903. The ore is hard, red, silicious Hematite. Open pit system of mining is used. The greatest vertical depth is 141 feet. The ore is crushed. The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there to the lower lake ports by boat.

Sales Agents: Rogers-Brown Iron Co., Buffalo, N. Y.

Y early	Shipments:	
•	1903— 8,739 tons	1907— 46,834 tons
	1904— 32,332 tons	1908— 27,773 tons
	1905— 92,183 tons	1909— 23,241 tons
	1906— 47,454 tons	1910— 20,022 tons

tons 1910— Total, Tons......298,578

#### NANAIMO MINE.

Location: Iron County, Michigan, Section 26, Township 43 Range 35.

Description; First opened up in 1882. The mine shipe JAMES ore, a soft, yellow, Non-Bessemer Hematite. Sub-level caving system of mining is used. The greatest vertical depth is 362 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

1889....

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

Dila				100		
1886— 1,585	tons			1890—		
1887— 1,226	tons			1891	1,400	tons
1888					,	
	Total,	Tons		.4,211		
Nanaimo				1890—	3,441	tons
1882— 2,480	tons			1891—		
1883— 29,221	tons			1904—		
1884— 37,620	tons			1905		
1885—				1906—		
1886— 5,400	tons			1907—	53,778	tons
1887— 30,460	tons			1908—	305	tons
1888— 5,744	tons			1909		
1889—				1910		
	Total	Tons	3	73.765		

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

James:

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 55.50
 .488
 8.73
 .22
 1.13
 .46
 .22
 .017
 8.72

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.00 51.06 .449 8.03

# OSANA MINE (Formerly James).

Location: Iron County, Michigan, Section 23, Township 43, Range 35.

Description: Re-opened in 1906. This mine ships JAMES ore, which is a soft, yellow, Non-Bessemer Hematite. Sub-level

caving system of mining is used. The greatest vertical depth is 428 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907— 2,360 tons 1908— 59,760 tons 1909— 90,851 tons 1910— 78,388 tons Total, Tons......231,359

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows:

James:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 55.50 .488 8.73 .22 1.13 .22 .017 8.72 .46

The Ore in its natural state is as follows:

James:

Phos. Silica Moist Iron .449 8.00 51.06 8.03

# PEWABIC MINE.

Location: Dickinson County, Michigan, Section 32, Township 40, Range 30.

**Description:** First opened up in 1887. There are five ores shipped from this mine, PEWABIC, a soft, blue, Bessemer Hematite; TOLEDO, a hard, red, high grade, silicious Hematite; GE-NOA, hard, red, silicious Hematite; WALPOLE, a soft, blue, Non-Bessemer Hematite; and TYRONE, a soft, blue, Bessemer Hematite. The sub-level and block caving system The greatest vertical depth is 941 feet. of mining is used. The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1890 26,991	tons	1901—507,786	
1891— 64,507	tons	1902—530,291	
1892—115,273	tons	1903—489,175	
1893—165,745		1904—372,791	
1894—304,010		1905—533,413	
1895—262,551	tons	1906—493,891	
1896—273,587		1907—457,796	
1897—279,855	tons	1908—365,341	
1898—305,072	tons	1909—465,453	
1899—530,129	tons	1910—380,376	tons
1900—374,043	tons		

Total, Tons........7,317,165

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F.

lows:

Pewabic: Phos. Mang. Alum. Lime Magnes. Sulph. Loss Iron Silica 1.31 59.80 .012 10.38 .12 1.04 .74 1.12 .006

Toledo: Iron 48.10	Phos014	Silica 25.78	Mang. .09	Alum. 1.40	Lime .89	Magnes. 1.35	Sulph. .015	Loss 1.79
Pewabic		~…						_
Iron 38.85	Phos. .012	Silica 39.34	Mang. .07	Alum. 1.49	Lime .58	Magnes. 1.48	Sulph. .009	Loss 1.48
Walpole:								
Iron 57.30	Phos. .074	Silica 7.01	Mang. .18	Alum. 1.66	Lime 1.99	Magnes. 3.16	Sulph. .005	Loss 3.93
Tyrone:								
Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
56.65	.030	11.56	.10	.83	1.66	1.75	.007	3.08
The C	Dre in i	its natu	ral state	is as	follows	:		

Walpole:

Moist Iron Phos. Silica 7.31 53.11 .0686 6.498

# QUINNESEC MINE.

Location: Dickinson County, Michigan, Section 34, Township 40, Range 30.

Description: First opened up in 1878. The ore is a soft, blue silicious Bessemer Hematite. The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

Diripinents.	
1878—25,925 tons	1895—
1879—41,954 tons	1896—
1880—52.436 tons	1897—
1881—43,711 tons	1898—
1882—44,240 tons	1899—11, <b>049</b> tons
1883—21,676 tons	1900—25,967 tons
1884—16.995 tons	1901—66,383 tons
1885—14.110 tons	1902—62,770 tons
1886—13,442 tons	1903—49,447 tons
1887— 6,585 tons	1904—
1888— 2,249 tons	1905—
1889	1906—
1890—	1907—
1891—	1908— 1,409 tons
1892—	1909— 3,147 tons
1893—	1910— 744 tons
1894—	

Total, Tons..........627,215

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 40,70
 .032
 37.40
 .07
 1.05
 1.45
 .77
 .006
 .95

The Ore in its natural state is as follown:

Moist Iron Phos. Silica 3.20 39.40 .031 36.20

#### RANDVILLE MINE.

Location: Dickinson County, Michigan, Section 31, Township 42 North, Range 29 West.

Description: The mine is at present an exploration. The ore is hard, blue silicious Hematite.

The ore is shipped via the C. M. & St. P. Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: E. N. Breitung & Co,. Cleveland.

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 42.70 .024 36.24 .15 .42 .40 .25 .006 1.00 .

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 4.00 40.99 .023 34.79

#### RIVERTON MINE.

Location: Iron County, Michigan, Sections 1, 35 and 36, Townships 42 and 43, Range 35.

Description: First opened up in 1898. The mine ships the BAR-TON ore, a hard, yellowish brown, Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 696 feet.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Barton:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.20 .611 6.12 .21

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 7.64 51.91 .564 5.65

Yearly Shipments:

Total, Tons......2,195,146

## TOBIN MINE.

Location: Iron County, Michigan, Section 30, Township 43, Range 32.

Description: First opened up in 1901. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used.

The ore is crushed.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

# Yearly Shipments:

•	
1901— 18,957 tons	1906—235,867 tons
1902— 55,238 tons	1907—237,781 tons
1903— 54,386 tons	1908—161,642 tons
1904—113,669 tons	1909—359,668 tons
1905—166,529 tons	1910—235,812 tons
T . 1. T	1 620 540

Total, Tons ......1,630,549

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 57.05
 .595
 6.82
 .32
 1.69
 2.90
 2.68
 .007
 2.83

 The Ore in its matural state is as follows:

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.28 52.33 .546 6.25

### TULLY MINE.

Location: Iron County, Michigan, Section 36, Township 43, Range 35 West.

**Description:** First opened up in 1909. The ore is soft, red, Non-Bessemer Hematite. Underground system of mining is used. The ore is crushed.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

# Yearly Shipments:

1910-2,726 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 56.72
 .516
 7.95
 .42
 1.73
 2.09
 1.56
 .007
 4.32

 CIT
 .00
 .00
 .00
 .00
 .00
 .00
 .00

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.91 51.67 .470 7.24

#### VIVIAN MINE.

Location: Dickinson County, Michigan, Section 34, Township 40, Range 30 West.

Description: First opened up in 1902. The ore is a silicious Hematite. Underground system of mining is used. The greatest vertical depth is 310 feet. The ore is crushed.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

# Yearly Shipments:

1902 40,384 tons	1907— 48,493 tons
1903— 12,122 tons	1908— 10,056 tons
1904 81,354 tons	1909—
1905— 90,426 tons	1910— 14,827 tons
1906—122,577 tons	

Total, Tons .........420,239

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 37.60 .016 40.82 .05 1.18 1.15 1.29 .009 1.72

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 3.00 36.47 .016 39.60

# WEST VULCAN, CURRY AND BRIER HILL MINES.

Location: Dickinson County, Michigan, Section 9 and 10, Township 39, Range 29.

Description: First opened up in 1877. There are five ores shipped from these mines, CYCLOPS and VULCAN, medium hard, blue and brown, Bessemer, red Hematites; HARPER, a medium hard, blue and brown, Non-Bessemer, red Hematite; JUPITER, a medium hard, blue and brown, silicious, Bessemer, red Hematite; and MARS, a medium hard, blue and brown, silicious Non-Bessemer, red Hematite. The mines are worked under the following systems: Caving, underhand stoping, and rooms and pillars with square set timbering. The greatest vertical depth is 1,500 feet.

The ore is shipped via the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railways to Escanaba, and from there by boat to the lower lake ports.

Owners: Penn Iron Mining Co.

## Yearly Shipments:

Prior to 1893, reported separately as Vulcan, Norway, Clyclops and Curry, a total of 3,663,027 tons. After 1893 shipments reported under the heading of Penn Iron Mining Co. See Clyclops and Norway Mines.

See Cyclops and Norway Mines for Analysis.

# YOUNGS MINE.

Location: Iron County, Michigan, E. 1/2 of Section 12, Township 42, Range 35.

Description: First opened up in 1905. The ore is hard, red, Non-Bessemer Hematite. The milling and underhand stoping systems of mining are used. The greatest vertical depth is 419 feet. The ore will be crushed this year.

The ore is shipped via the Chicago & Northwestern Railway to Escanaba and from there by boat to the lower lake ports.

Sales Agents: The Lake Erie Ore Co., Cleveland.

Yearly Shipments:

1905— 10,926 tons 1908— 70,094 tons 1906— 47,583 tons 1909—154,150 tons 1910— 98,399 tons 1907— 92,632 tons Total, Tons......473,784

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Phos. Mang. Alum. Lime Magnes. Sulph. Iron Silica Loss 55.40 .336 9.92 .14 3.17 .75 1.01 4.90

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 7.58 51.20 .311

# MAYVILLE RANGE

### IRON RIDGE MINE.

Location: Dodge County, Wisconsin, Sections 1, 12, 13, 16 and 36, Townships 11 and 12, Range 16.

Description: First opened up in 1903. The ore is soft, yellowish brown, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to Escanaba and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1903— 17,913 tons	1907— 3,966 tons
1904— 19,558 tons	1908—
1905— 39,9 <b>7</b> 8 tons	1909— 15,955 tons
1906 61,634 tons	1910— 14,487 tons
T-4-1 T	172 401

Total, Tons ......173,481

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron	Phos.	Silica	Mang.	Alum.	Lime	Magnes.	Sulph.	Loss
44.95	1.68	5.75	.17	4.35	7.48	2.51	.062	11.40
44.93	1.06	3.73	.17	4.33	7.40	2.31	.002	11.70

### MAYVILLE MINE.

Location: Dodge County, Wisconsin, Section 12, Township 11, Range 16.

Description: First opened up in 1893. Open pit and steam shovel systems of mining are used. The greatest vertical depth is 50 feet. The ore is soft, red and brown, Non-Bessemer Hematite. It is locally known as "Flax Seed" ore. The ore is crushed.

The ore is shipped via the Chicago, Milwaukee & St. Paul Railway to The Mayville Furnace Company.

Yearly Shipments:

Prior to 1893—9,044	1902— 23,338 tons
1893— 7,925 tons	1903— 18,836 tons
1894— 10,511 tons	1904— 26,562 tons
1895— 16,472 tons	1905— 20,610 tons
1896— 13,144 tons	1906— 15,847 tons
1897— 10,546 tons	1907— 19,644 tons
1898— 18,151 tons	1908— 71,341 tons
1899— 19,731 tons	1909— 66,804 tons
1900— 20,986 tons	1910— 77,195 tons
1901— 22.400 tons	

Total, Tons .......489,087

The average of all cargo analysis for 1910 is as fol-Dried at 212° F. Analysis:

lows:

Iron 46.27 Silica 5.73 Mang. Lime Magnes. Sulph. 6.33 3.12 Phos. Alum. Loss 1.09 4.00

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.90 41.69 .982 5.16

# MESABI RANGE

### ADAMS MINE.

Location: St. Louis County, Minnesota, Sections 31 and 36, Township 58, Ranges 17 and 18.

**Description:** First opened up in 1895. GILWOOD ore, soft, slate colored, silicious, Bessemer Hematite. Ore from this mine goes into Groups 1, 4, Special Group 4, and Group One, High Manganese.

An open pit and underground mine. Greatest vertical depth

is 314 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there to the lower lake ports by boat. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1895— 59,141 tons	1903—1,109,750 tons
1896— 234,562 tons	1904— 940,105 tons
1897— 170,738 tons	1905—1,140,984 tons
1898— 390,860 tons	1906—1,238,350 tons
1899— 720,474 tons	1907—1,136,513 tons
1900— 777,346 tons	1908— 765,592 tons
1901— 829,118 tons	1909—1,829,372 tons
1902—1,242,923 tons	1910—1,258,295 tons
Total, Tons	13.844.123

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Gilwood:

Iron Phos, Silica Mang. Alum. Lime Magnes. Sulph. Loss 53.08 .032 16.03 .45

Group No. 1 High Manganese:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.70 .043 5.23 3.19

The Ore in its natural state is as follows:

Gilwood:

Moist Iron Phos. Silica 12.48 46.45 .025 14.03

Group No. 1 High Manganese:

Moist Iron Phos. Silica 11.88 50.01 .038 4.61

See Analysis of Groups Nos. 1 and 4.

#### ADRIATIC MINE.

Location: St. Louis County, Minnesota, Section 30, Township 59, Range 14 West.

Description: First opened up in 1906. The ore is Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 145 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1906— 3,294 tons 1909—107,307 tons 1907— 70,187 tons 1910—135,685 tons 1908—108,129 tons

Total Tons .......424,612

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.20 .078 10.55 .22 1.98 .36 .24 .007 6.10

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.50 49.74 .069 9.33

#### AGNEW MINE.

Location: St. Louis County, Minnesota, Section 11, Township 57 North, Range 21 West.

**Description:** First opened up in 1902. This ore is a soft, red, Bessemer Hematite. It is an open pit mine.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Owners: The Wisconsin Steel Co.

Yearly Shipments:

1902— 45,582 tons 1907—149,084 tons 1903—108,847 tons 1904— 96,435 tons 1909—151,536 tons 1905— 44,651 tons 1906—163,260 tons

Total, Tons .......1,076,715

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.51 .051 8.68 .70 1.99

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.73 49.89 .043 7.40

# AJAX MINE (Formerly Kanawha Mine).

Location: St. Louis County, Minnesota, Section 1, Township 58, Range 16.

**Description:** First opened up in 1899. The ore is soft, yellow, Non-Bessemer Hematite. It is an open pit mine.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland, O.

Yearly Shipments:

1899— 14,963	tons		1903— 23,932 tons
1900 64,218			1904— 912 tons
1901— 41,300			1905— 28,439 tons
1902— 24,829	tons		1906— 9,057 tons
	Total,	Tons	207,650

### AUBURN MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 17.

Description: First opened up in 1894. Two ores are shipped from this mine, Bessemer and Non-Bessemer Hematite.

Operated by The Oliver Iron Mining Company. Now idle.

Yearly Shipments:

1894-108,210	tons	1899—385,992	tons
1895-376,970	tons	1900—263,692	tons
1896—131,478	tons	1901—427,510	tons
1897—175,263	tons	1902— 38,283	tons
1898-235.630	tons		

Total, Tons ......2,143,028

#### BANGOR MINE.

Location: St. Louis County, Minnesota, Sections 1 and 6, Township 58, Ranges 16 and 15.

Description: First opened up in 1910. The ore is Non-Bessemer Hematite. Underground mining system used. Greatest vertical depth 307 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

# Yearly Shipments:

1910— 17,673 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 56.50
 .081
 8.87
 .96
 2.81
 .23
 .20
 .008
 .5.76

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.00 49.72 .071 7.80

#### BESSEMER MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1904. Two grades of ore are shipped from this mine, a soft, red, Bessemer and Non-

Bessemer Hematite. Slicing system of mining used. Greatest

vertical depth, 210 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, Minnesota, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1904— 86,303 tons 1905—112,630 tons 1906—131,791 tons 1907— 78,012 tons 1908—120,350 tons 1909—227,767 tons 1910—117,173 tons

Total, Tons ......874,026

The average of all cargo analysis for 1910 is as fol-Analysis: Dried at 212° F. lows:

Bessemer No. 3, 1st Grade:

Lime Magnes. Sulph. Loss Phos. Silica Mang. Alum. 9.95 1.03 58.00 .050

Bessemer No. 3, and Grade:

Loss Silica Alum. Lime Magnes. Sulph. Iron Phos. Mang. 56.78 .058 11.20 1.45

The Ore in its natural state is as follows:

Bessemer No. 3, 1st Grade: Moist Iron Phos. Silica

Silica 8.20 53.24 .046 9.13

Bessemer No. 3, and Grade: Moist Iron Phos. Silica

Silica Mang. 8.44 51.99 .053 10.25

#### BIWABIK MINE.

Location: St. Louis County, Minnesota, Sections 2 and 3, Township 58, Range 16.

First opened up in 1893. This mine ships two Description: ores, BIWABIK, a Bessemer Hematite and SHILLING, a Non-Bessemer Hematite.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The Tod-Stambaugh Company, Cleveland.

Mine shipment for 1910 was 544,353 tons.

#### BRAY MINE.

Location: Itasca County, Minnesota, Section 23, Township 57, Range 22.

Description: First opened up in 1909. This mine ships two grades of ore, both red, Non-Bessemer Hematites. shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports. Sales Agents: Oglebay, Norton & Company, Cleveland.

Yearly Shipments:

.1909— 65,514 tons

1910— 57,789 tons

Total, Tons ......123,303

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows:

Bray Ore:

Iron Phos. Mang. Alum. Magnes. Loss Silica Lime Sulph. 59.92 .070 6.52 1.22 1.93 .20 .18 .006 4.35

Bray No. 2 Ore:

Phos. Magnes. Iron Silica Mang. Alum. Lime Sulph. Loss 59.56 .070 6.88 1.42 1.88 .20 .18 .006 4.27

The Ore in its natural state is as follows:

Bray Ore:

Moist Iron Pros. Silica 5.65 13.42 51.88 .061

Bray No. 2 Ore:

Moist Iron Phos. Silica 12.33 52.22 .061

## BRUNT MINE.

Location: St. Louis County, Minnesota, Section 10, Township 58, Range 18.

Description: First opened up in 1906. Two ores shipped from this mine BRUNT, a Non-Bessemer, soft, red, Hematite and MARION, a soft, red, Bessemer Hematite. Steam shovel mining is used.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 75,401 tons 1907—178,935 tons 1908---636 tons

1909— 14,212 tons 1910-110,630 tons

Total, Tons ......379,814

The average of all cargo analysis for 1910 is as fol-Analysis: Dried at 212° F. lows:

Brunt: Lime Magnes. Iron Phos. Silica Mang. Alum. Sulph. Loss 56,42 .054 .49 5.75 .28 .80 .1235.39 6.72

Marion: 56.43 .046 5.87 .50 5.51 .29 .37 .150 5.85

The Ore in its natural state is as follows:

Brunt:

Iron Phos. Silica Moist .046 15.22 47.83 5.70

Marion:

Phos. Silica Moist Iron 47.84 .039 15.23

## BURT MINE.

Location: St. Louis County, Minnesota, Sections 31 and 36, Township 58, Ranges 20 and 21.

**Description:** First opened up in 1895. Ore from this mine goes into Groups 2, 3, 5 and 7. It is a soft Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe and Northern Railway to Duluth, and from there by boat to the lower lake

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

 1905—1,860,452 tons
 1908—1,460,998 tons

 1906—1,376,875 tons
 1909—1,660,101 tons

 1907—1,501,272 tons
 1910—1,032,815 tons

 Total, Tons
 ......8,892,513

See Analysis of Groups Nos. 2, 3, 5 and 7.

### CANISTEO MINE.

Location: Itasca County, Minnesota, Sections 29, 30 and 31, Township 56, Range 24.

Description: First opened up in 1907. This mine ships ALCON ore, a soft and hard, dark, brown Hematite; a soft, brown, Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, brown, Bessemer Hematite which goes into Groups 2 and 5.

Open pit system of mining is used. Greatest vertical depth 210 feet.

The ore is shipped to Duluth via the Duluth, Missabe and Northern Railway, and from there to the lower lake ports by boat.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1907— 5,454 tons 1909— 85,505 tons 1908— 2,760 tons 1910—1,105,160 tons Total, Tons ......1,198,879

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alcon:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.81 .047 11.90 .34

The Ore in its natural state is as follows:

Alcon:

Moist Iron Phos. Silica 10.45 50.87 .042 10.66

See Analysis of Groups Nos. 2, 3, 5 and 7.

### CANTON MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 16.

**Description:** First opened up in 1893. The ore is a Bessemer Hematite.

Operated by the Oliver Iron Mining Company.

Yearly Shipments:

1893— 24,416 tons 1897—
1894—213,853 tons 1898—
1895—359,020 tons 1899— 99,498 tons
1896— 16,261 tons

Total, Tons .......713,048

### CHISHOLM MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1901. Ore is a soft, brown and dark red, Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, dark yellow Bessemer Hematite, which goes into Group 2. Underground system of mining is used. Greatest vertical depth 255 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

 1901— 34,573 tons
 1906—379,156 tons

 1902—200,629 tons
 1907—258,793 tons

 1903—168,831 tons
 1908—228,386 tons

 1904—130,732 tons
 1909—314,597 tons

 1905—231,296 tons
 1910—634,236 tons

Total, Tons .....2,581,229

See Analysis of Groups Nos. 2, 3 and 7.

# CLARK MINE.

**Location:** St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1900. This ore is a soft, Bessemer and Non-Bessemer Hematite, goes into Groups 2 and 3. Underground system of mining is used. Greatest vertical depth 201 feet.

The ore is shipped via the Duluth, Missabe and Northern Railway and the Great Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

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    Yearly
    Shipments:

    1900- 63,071 tons
    1906—274,394 tons

    1901-199,566 tons
    1907—319,983 tons

    1902-350,799 tons
    1908—334,594 tons

    1903-300,492 tons
    1909—484,512 tons

    1904-256,873 tons
    1910—529,222 tons

    1905-358,091 tons
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Total, Tons .....3,471,597

See Analysis of Groups Nos. 2 and 3.

### COLUMBIA MINE.

**Location:** St. Louis County, Minnesota, Section 6, Township 58, Range 17.

Description: First opened up in 1901. The ore is a soft, Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 160 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: W. G. Pollock, Cleveland.

Yearly Shipments:

1901— 15,627 tons 1905— 1,360 tons
Total, Tons ......16,987

#### COMMODORE MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1893. Two ores are shipped from this mine, ADMIRAL, a soft, blue, Bessemer Hematite and COMMODORE, a soft, blue, Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Company, Cleveland.

Yearly Shipments:

tons		1902— 65,833	tons
tons			
		1904— 249	tons
tons		1905—146,901	tons
tons		1906—263,401	tons
tons		1907—477,203	tons
tons		1908—116,069	tons
tons			
tons		1910—341,548	tons
Total,	Tons	2,543,402	
	tons tons tons tons tons tons tons tons	tons tons tons tons tons tons tons tons	tons 1903— 20,436 1904— 249 tons 1905—146,901 tons 1906—263,401 tons 1908—116,069 tons 1909—409,148

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Commodore:

Iron 58.80	Phos056	Silica 6.50	Mang. .72	Alum. 1.82	Lime .61	Magnes.	Sulph. .006	Loss 3.81

Admiral:

Phos. Mang. Silica Alum. Lime Magnes. Iron Sulph. Loss 61.22 2.90 .044 6.25 .88 1.16 .60 .27 .008

The Ore in its natural state is as follows:

Commodore:

Moist Iron Phos. Silica 10.47 52.64 .050 5.82

Admiral:

Moist Iron Phos. Silica 9.70 55.28 .040 5.64

### CORSICA MINE.

Location: St. Louis County, Minnesota, Section 18, Township 58, Range 16 West.

**Description:** First opened up in 1901. The ore is Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 163 feet.

Ore shipped via the Duluth and Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company.

Yearly Shipments:

 1901— 26,838 tons
 1906—100,606 tons

 1902— 59,292 tons
 1907—172,226 tons

 1903— 34,043 tons
 1908— 77,674 tons

 1904— 30,131 tons
 1909—135,366 tons

 1905—
 1910—277,537 tons

Total, Tons .......913,713

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 57.30
 .048
 9.24
 .46
 1.81
 .27
 .25
 .009
 5.75

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.00 51.00 .043 8.22

### CROSBY MINE.

Location: Itasca County, Minnesota, Sections 31 and 32, Township 57, Range 22.

Description: First opened up in 1903. The ore is a soft, Bessemer Hematite. Open pit, milling and underground systems of mining are used. The greatest vertical depth is 80 feet. The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: The Cleveland-Cliffs Iron Company, Cleveland.

Yearly Shipments:

1906—115,373 tons 1907—227,265 tons 1908—152,084 tons 1910—159,569 tons

Total, Tons ......837,761

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.00 .035 14.85 .49 1.31 .31 .23 .015 1.95

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.00 50.96 .032 13.51

### CROXTON MINE.

Location: St. Louis County, Minnesota, Section 13, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red Non-Bessemer Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1902— 18,594 tons 1907—349,853 tons 1903—100,297 tons 1908—154,868 tons 1904— 348 tons 1909—159,038 tons 1905—130,228 tons 1910—71,632 tons 1906—162,533 tons

Total, Tons .....1,147,391

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.40 .067 8.81 .33 1.92 .24 .23 .014 6.18

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.09 51.03 .060 7.83

### CYPRUS MINE.

Location: St. Louis County, Minnesota, Section 3, Township 57, Range 21 W.

Description: First opened up in 1903. Two ores are shipped from this mine, CYPRUS, a Non-Bessemer Hematite; and ATHENS, a Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 134 feet.

This ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

_	1903—121,818 tons		1907—260,948 tons
	1904—244,343 tons	•	1908—115,745 tons
	1905—235,351 tons		1909—107,685 tons
	1906—192,144 tons		1910—102,233 tons
	To	tal, Tons	1,380,267
A 1	in. The everyone of	11	1:- fam 1010 :

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Cyprus: Iron 60.25	Phos. .065	Silica 6.13	Mang.	Alum. 1.61	Lime .27	Magnes.	Sulph. .010	Loss 5.00
Athens: Iron 60.80	Phos040	Silica 7.04	Mang. .28	Alum. 1.08	Lime .20	Magnes. .21	Sulph. .010	Loss 4.18
The	Ore in i	ts natu	al state	is as	follows	:		

		Phos057	
Athens:	_		

Yearly Shipments:

Moist Iron Phos. Silica 9.80 54.84 .036 6.35

# DAY MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1898. Bessemer and Non-Bessemer Hematite ores were shipped.

The mine was operated by The Oliver Iron Mining Company.

Now idle.

Yearly Shipments:

ompinents.	
1898— 18,651 tons	1902—106,516 tons
1899— 1,975 tons	1903—107,781 tons
1900	1904— 84,530 tons
1901—	

Total, Tons ......319,453

# DULUTH MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 16.

Description: First opened up in 1893. The ore is a soft, brown, Bessemer Hematite. This ore goes into Groups 1 and 2. Milling system of mining is used. Greatest vertical depth 114 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly	Shipments:		
•	1893— 37,626 tons	1902-150,220	tons
	1894	1903—150,053	
	1895	1904—149,819	tons
	1896—	1905—142,172	
	1897—	1906—158,336	
	1898—112,155 tons	1907— 93,120	tons
	1899—165,435 tons	1908—149,185	
	1900—128,587 tons	1909—150,501	
	1901—150.024 tons	1910- 57 239	tons

Total, Tons ......1,794,472

See Analysis of Groups Nos. 1 and 2.

# ELBA MINE.

Location: St. Louis County, Minnesota, Section 13, Township 58, Range 17 West.

**Description:** First opened up in 1898. The ore is a Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 246 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

ompinents.		
1898— 564	tons	1905—125,724 tons
1899— 9,547		1906—255,580 tons
1900—121,707	tons	1907—134,488 tons
1901—224,630		1908—147,916 tons
1902207,454		1909—224,202 tons
1903— 93,61,6	tons	1910—186,993 tons
1904-123.425	tons	

Total, Tons ......1,855,846

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Phos. Silica Mang. Lime Magnes. Sulph. Iron Alum. Loss 59.10 1.12 .24 .042 7.91 .78 4.90 .008

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.20 53.66 .038 7.18

#### EUCLID MINE.

Location: St. Louis County, Minnesota, Section 21, Township 58, Range 20.

Description: First opened up in 1909. Two ores are shipped from this mine, EUCLID, a soft, dark, brown, Non-Bessemer Hematite, and MADEIRA, a soft, dark, brown Bessemer Hematite.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 82,637 tons 1910— 53,009 tons

Total, Tons ......135,646

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Euclid:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.60 ..093 7.54 .80 1.58 .27 .26 .012 5.28

Madeira: Iron

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 61.50 .044 5.67 .82 1.50 .18 .012 3.40 .20

The Ore in its natural state is as follows:

Euclid:

Moist Iron Phos. Silica 12.50 51.28 .081 6.60

Madeira:

Moist Iron Phos. Silica 10.50 55.04 .039 5.08

# FAYAL MINE.

Location: St. Louis County, Minnesota, Sections 5 and 6, Township 57, Range 17.

Description: First opened up in 1895. The ore is soft, brown and yellow Bessemer and Non-Bessemer Hematite. This ore goes into groups 1, 2 and 4. Underground and open pit systems of mining are used. Greatest vertical depth 266 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1895— 136,601 tons 1903—1,460,601 tons 1896---1904— 975,102 tons 248,645 tons 1897— 642,939 tons 1905—1,358,922 tons - 575,933 tons 1898-1906—1,634,853 tons 1899-1,072,257 tons 1907—1,878,812 tons 1900-1,252,504 tons 1908—1,439,879 tons 1909—1,879,357 tons 1910—1,485,099 tons 1901—1,656,973 tons 1902-1,919,172 tons

Total, Tons ......19,617,649 See Analysis of Groups Nos. 1, 2 and 4.

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# FOREST MINE.

Location: Itasca County, Minnesota, S. E. 1/4 of N. W. 1/4, Section 13, Township 57, Range 22.

**Description:** First opened up in 1904. The ore is a soft, red Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 65 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1910—8,264 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.00 .040 10.00 .90 1.40 .25 .19 .020 3.50

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.00 51.62 .036 8.90

# FOWLER MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 15.

Description: First opened up in 1907. The ore is a soft, yellow, Non-Bessemer Hematite. Caving and slicing systems of mining are used. Greatest vertical depth 132 feet.

The ore is shipped via the Duluth and Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1907— 34,014 tons 1909— 99,892 tons 1908— 21,511 tons 1910—204,640 tons Total, Tons .......360,057

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 54.90 .064 12.47

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.14 47.14 .055 10.71

# FRANKLIN MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1893. The ore is soft, red, blue and yellow Bessemer Hematite. Slicing system of mining is used. Greatest depth 200 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Company, Cleveland.

Yearly Shipments:

1893— 46,617	tons		1902—111,085 tons
1894—223,399	tons		1903— 92,019 tons
1895—286,423	tons		1904— 65,528 tons
1896—231,086	tons		1905—
1897— 30,128	tons		1906— 66,935 tons
1898200,400	tons		1907— 30,926 tons
1899 60,000			1908— 8,246 tons
1900168,524			1909— 51,393 tons
1901— 39,299			1910— 31,614 tons
	T-4-1	Т	1 742 622

Total, Tons ......1,743,622

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.35 .033 8.98 .83

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 6.45 55.52 .031 8.40

#### FRANTZ MINE.

Location: St. Louis County, Minnesota, Section 21, Township 58, Range 19.

Description: First opened up in 1904. The ore is soft, red Non-Bessemer Hematite. Slicing system of mining is used. The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

### GENOA MINE.

Location: St. Louis County, Minnesota, Section 34, Township 58, Range 17.

Description: First opened up in 1896. The ore is a soft, yellow, Non-Bessemer Hematite ore, goes into Group 4. Open pit and underground systems of mining are used. Greatest vertical depth 319 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1896-- 17,136 tons 1904—244,150 tons 1905-281,081 tons 1897—309,514 tons 1906-179,468 tons 1898--279,677 tons 1899-276,559 tons 1907—108,610 tons 1900-253,651 tons 1908-1901—332,022 tons 1902—399,719 tons 1909-1910-283,299 tons 1903—303,700 tons

Total, Tons ......3,268,586

See Analysis of Group No. 4.

# GILBERT MINE.

Location: St. Louis County, Minnesota, Section 26, Township 58, Range 17.

Description: First opened up in 1907. Soft, brown Bessemer ore goes into Group 1; soft, yellow Non-Bessemer ore goes into Group 4; a soft, grey, silicious Bessemer ore, called GILL-WOOD. Underground and open pit systems of mining are used. Greatest vertical depth 224 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—100;178 tons 1909—783,683 tons 1908—336,927 tons 1910—110,788 tons Total, Tons .....1,331,576

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Gillwood:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 53.08 .032 16.03 .45

The Ore in its natural state is as follows:

Gillwood:

Moist Iron Phos. Silica 12.48 46.45 .028 14.03

See Analysis of Groups Nos. 1 and 4.

#### GLEN MINE.

Location: St. Louis County, Minnesota, Section 29, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red and brown Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, yellow Bessemer Hematite which goes into Group 2. Underground system of mining is used. Greatest vertical depth is 265 feet.

The ore is shipped via the Duluth, Missabe and Northern Railway to Duluth, and from there by boat to the lower lake ports.

This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1902— 23,875	tons	1907—205,426 tons
1903—171,705	tons	1908—272,142 tons
1904280,412	tons	1909—396,591 tons
1905—287,835		1910—286,051 tons
1006 270 424	toma	* .

Total, Tons ......2,203,461

See Analysis of Groups Nos. 2, 3 and 7.

### GRANT MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 19.

**Description:** First opened up in 1902. The ore is soft, bluish, Non-Bessemer Hematite. Open pit system of mining is used. Greatest vertical depth 126 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

DIII DIII COI CO	
1902— 51,946 tons	1907—
1903— 18,928 tons	1908—
1904— 44,413 tons	1909—
1905— 49,227 tons	1910—297,761 tons
1906—	

Total, Tons .......362,275

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.06 .112 7.35

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.31 50.91 .098 6.44

### GROUP No. 1.

This Group is made up of ore from the following mines: Adams, Duluth, Faval. Gilbert and Spruce.

The ore is a soft, red, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.22 .042 5.66 .55

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.12 52.92 .037 4.98

## GROUP NO. 2.

This Group is made up of ore from the following mines: Burt, Canisteo, Chisholm, Clark, Duluth, Fayal, Glen, Higgins, Hill, Holman, Hull-Rust, Morris, Myers, Sellers, Virginia and Winifred.

The ore is a soft, brown, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 60.97 .051 5.63 .62

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.74 54.42 .045 5.02

### GROUP NO. 3.

This Group is made up of ore from the following mines: Burt, Canisteo, Chisholm, Clark, Glen, Hartley, Holman, Hull-Rust, Leonard, Morris, Virginia, Winifred.

The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.06 .091 6.79 1.15

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.20 49.52 .079 5.89

# GROUP NO. 4.

This Group is made up of ore from the following mines: Adams, Fayal, Genoa, Gilbert, and Spruce. The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.07 .072 7.19 .91

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 15.76 47.23 .060 6.05

#### GROUP NO. 5.

This Group is made up of ore from the following mines: Burt, Canisteo, Higgins, Holman, Hull-Rust, Morris, Sellers, and Winifred.

The ore is a soft, brown, Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.70 .043 12.99 .44

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.11 50.40 .038 11.55

### GROUP NO. 7.

This Group is made up of ore from the following mines: Burt, Canisteo, Chisholm, Glen, Hartley, Hill, Holman, Hull-Rust, Leonard, Morris, Virginia, and Winifred. The ore is a soft, brown, Non-Bessemer Hematite.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 53.45 .094 12.31 .84

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.15 46.42 .081 10.69

### HANNA MINE.

Location: St. Louis County, Minnesota, Sections 2 and 3, Township 58, Range 18.

Description: First opened up in 1909. Two ores are shipped from this mine, HANNA No. 1, a soft, red, Non-Bessemer Idematite; and HANNA No. 2, a soft, red Non-Bessemer Manganiferous Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1909-238,873 tons 1910-308,009 tons Total, Tons ......546,882

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Hanna No. 1:

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron 5.55 57.60 .084 5.95 1.17 3.65 .83 .25 .016

Hanna No. 2:

Lime Magnes. Alum. Sulph. Phos. Silica Mang. Loss Iron .33 3.07 .49 .006 5.47 57.12 .077 6.02 2.20

The Ore in its natural state is as follows:

Hanna No. 1:

Moist Iron Phos. Silica 13.40 49.88 .073 5.15 Hanna No. 2: Moist Iron Phos. Silica 13.21 49.57 .067 5.22

### HARTLEY MINE.

Location: St. Louis County, Minnesota, Sections 23 and 24, Township 58, Range 20.

Description: First opened up in 1907. The ore is soft, dark red Non-Bessemer Hematite, which goes into Groups 3 and 7. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. This mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907—334,646 tons 1909—
1908— 55,462 tons 1910—113,512 tons
Total, Tons .......503,620

See Analysis of Groups 3 and 7.

### HAWKINS MINE.

Location: Itasca County, Minnesota, Sections 31 and 32, Township 57 North, Range 22 West.

Description: First opened up in 1902. Two ores are shipped from this mine, NANOBE, a soft, red Non-Bessemer Hematite; and HAWKINS, a soft, red Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Owners: Wisconsin Steel Co.

Yearly Shipments:

 1902
 5,892 tons
 1907
 270,984 tons

 1903
 107,905 tons
 1908
 248,246 tons

 1904
 99,055 tons
 1909
 316,783 tons

 1905
 202,070 tons
 1910
 224,406 tons

 1906
 294,588 tons

Total, Tons ......1,769,929

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Hawkins

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.44 .045 11.60 .16 1.78

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.65 50.75 .040 10.25

# HECTOR MINE (formerly Hale Mine).

Location: St. Louis County, Minnesota, Section 1, Township 58, Range 16.

Description: First opened up in 1893. The ore is soft, yellow Non-Bessemer Hematite. Milling and underground mining systems used. Greatest vertical depth is 162 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1893— 3,616	tons		1902— 54,289 tons
1894— 24,167	tons		1903—
1895— 31,004	tons		1904—
1896— 70,006	tons		1905— 4,990 tons
1897— 13,728	tons		1906— 37,221 tons
1898—			1907— 65,952 tons
1899— 18,807	tons		1908—
1900— 32,901	tons		1909— 30,726 tons
1901— 30,929	tons		1910— 82,393 tons
	Total.	Tons	500.729

Analysis: The average of all cargo analysis for 1910 is as fol-

lows:

Dried at 212° F.
Phos. Silica Mang. Alum. Lime Magnes. Sulph. Iron Loss 12.59 54.00 .069

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.53 46.15 .059 10.76

#### HELMER MINE.

Location: St. Louis County, Minnesota, Section 14, Township 58,

Range 19.

Description: This mine is not yet opened up. Open pit system of mining will be used. The ore is Non-Bessemer Hematite.

### HIGGINS MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58,

Range 17.

Description: First opened up in 1904. The ore is soft, dark gray, Bessemer Hematite. This ore goes into Groups 2 and 5 and Chemung Groups 2 and 5. Underground, milling and open pit systems of mining are used. Greatest vertical depth

The ore is shipped via the Duluth. Missabe & Northern Railway to Duluth, and from there by boat to the lower lake

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1908---1904— 35,286 tons 1905-238,598 tons 1909-322,504 tons 1910-151,854 tons 1906-341,319 tons 1907-173,439 tons

Total, Tons ......1,263,000

See Analysis of Groups Nos. 2 and 5.

### HILL MINE.

Location: Itasca County, Minnesota, Section 17, Township 56, Range 23.

Description: First opened up in 1910. The ore is soft, brown Bessemer Hematite which goes into Group 2, and soft, brown Non-Bessemer Hematite which goes into Group 7. Open pit system of mining is used.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1910—801,088 tons

See Analysis of Groups Nos. 2 and 7.

### HOBART MINE.

**Location:** St. Louis County, Minnesota, Section 25, Township 58, Range 17.

**Description:** First opened up in 1906. The ore is a soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 248 feet.

This ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 975 tons 1907— 7,339 tons
Total, Tons .......8,314

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss, 59.00 .082 8.10 1.06 1.50 .22 .14 .010

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.00 53.10 .074 7.29

### HOLMAN MINE.

Location: Itasca County, Minnesota, Section 21, Township 56, Range 24.

Description: First opened up in 1907. This ore is a hard and soft, dark brown Bessemer Hematite called ALCON; a soft, dark brown Non-Bessemer Hematite which goes into Groups 3 and 7; and a soft, dark brown Bessemer Hematite which goes into Groups 2 and 5. Open pit system of mining is used. Greatest vertical depth 201 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

 1907—
 8,068 tons
 1909—391,157 tons

 1908—
 1,682 tons
 1910—413,873 tons

 Total, Tons
 .......814,780

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alcon:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.81 .047 11.90 .34

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.45 50.87 .042 10.66

See Analysis of Groups Nos. 2, 3, 5 and 7.

# JENNINGS MINE.

Location: St. Louis County, Minnesota, Section 14, Township 58, Range 19.

Description. First opened up in 1906. The ore is a soft, red, Non-Bessemer Hematite. Open pit system of mining is used. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 84,715 tons 1908— 18,313 tons 1907— 99,812 tons 1909— 10,477 tons

Total, Tons .......213,317

### HUDSON MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description; First opened up in 1910. The ore is Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1910—168,553 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Iron Loss 5.32 59.20 .065 .92 1.77 .18 .012 6.67 .21

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.50 51.80 .057 5.84

### HULL-RUST MINE.

Location: St. Louis County, Minnesota, Sections 1 and 2, Township 57, Range 21.

Description: First opened up in 1896. The ore is a soft, reddish brown Non-Bessemer which goes into Groups 3 and 7, and a soft, black and yellowish red Bessemer which goes into Groups 2 and 5. Open pit system of mining.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth, and from there by boat to the lower lake

ports.
The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1906—1,690,311 tons 1907—2,900,493 tons 1909—3,039,911 tons 1910-3,189,975 tons 1908-2,926,683 tons

Total, Tons ......13,747,373

See Analysis of Groups Nos. 2, 3, 5 and 7.

# JORDAN MINE.

Location: St. Louis County, Minnesota, Section 22, Township 58, Range 20.

Description: First opened up in 1902. Soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 193 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1902—147,931 tons 1903—190,024 tons 1907— 61,996 tons 1908—118,529 tons 1909— 12,754 tons 1904— 97,474 tons 1910- 20,314 tons 1905—185,854 tons 1906—110,768 tons

Total, Tons ......945,644

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows:

Mang. Phos. Loss Iron Silica Alum. Lime Magnes. Sulph. 7.48 60.36 .063 .54 1.18 .19 .14 .015 3.86

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.10 54.26 .057

# KELLOGG MINE.

Location: St. Louis County, Minnesota, N. W. 1/4 of N. E. 1/4, Section 9, Township 58, Range 16.

**Description:** First opened up in 1908. Two ores are shipped from this mine, KELLOGG, a soft, brown Bessemer Hematite, and KELLOGG No. 2, a soft, red Non-Bessemer Hematite. Caving system of mining is used. Greatest vertical depth is 190 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1908— 31,331 tons 1909—165,458 tons 1910-142,906 tons

Total, Tons ......339,695

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Kellogg:

Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Iron 13.54 1.86 .25 .031 3.17 56.10 .039 .60 .26

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.63 50.70 .035 12.24

# KINNEY MINE.

Location: St. Louis County, Minnesota, Section 14, Township 58, Range 19.

**Description:** First opened up in 1903. The ore is a soft, red Non-Bessemer Hematite; goes into first, second and third grades. Steam shovel system of mining is used. Greatest vertical depth 149 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1903— 32,352 tons 1907—145,989 tons 1904— 6,225 tons 1908—176,510 tons 1905— 89,161 tons 1906—57,697 tons 1910—401,920 tons Total, Tons .....1,197,269

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Kinney No. 1: Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss Tron .032 5.07 3.96 1.84 .25 60.80 .080 .75 Kinney No. 2: Alum. Lime Magnes. Sulph. Loss Phos. Silica Mang. Iron .041 6.19 59.70 4.16 1.25 1.85 .10 .15 .084 Kinney No. 3: Lime Silica Mang. Alum. Magnes. Sulph. Loss Phos. Iron 7.45 4.92 2.28 2.65 .30 56.71 .081

The Ore in its natural state is as follows:

Kinney No. 1.

Moist Iron Phos. Silica 13.47 52.61 .069 3.43

Kinney No. 2:

Moist Iron Phos. Silica 13.13 51.86 .073 3.61

Kinney No. 3:

Moist Iron Phos. Silica 13.31 49.16 .070 4.27

# KNOX MINE.

Location: St. Louis County, Minnesota, S. E. 1/4 of S. W. 1/4, Section 19, Township 59, Range 14.

Description: First opened up in 1909. The ore is a soft, red Non-Bessemer Hematite. Caving system of mining used. Greatest vertical depth 117 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Owners: The New York State Steel Company.

Yearly Shipments:

1909— 7,464 tons 1910— 50,942 tons

Total, Tons .......58,406

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.79 .074 11.03 .25

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.50 51.14 .065 9.76

#### LABELLE MINE.

Location: St. Louis County, Minnesota, Section 24, Township 58, Range 17 West.

Description: First opened up in 1901. The ore is a soft, brown Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 220 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The LaBelle Iron Works, Steubenville, Ohio.

Yearly Shipments:

 1902— 70,753 tons
 1907— 56,146 tons

 1903— 48,298 tons
 1908— 51,638 tons

 1904— 89,554 tons
 1909— 27,216 tons

 1905— 78,597 tons
 1910— 20,349 tons

1906— 50,466 tons
Total, Tons ......493,017

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. 55.94 .037 9.79 .82 1.01 .44 3.32 .28

The Ore in its natural state is as follows:

Moist Iron 13.26 48.57 Phos. Silica .032 8.41

# LARKIN MINE (formerly Tesora Mine).

**Location:** St. Louis County, Minnesota, N. E. 1/4 of N. E. 1/4, Section 4, Township 58, Range 17.

Description: First opened up in 1906. The ore is a soft, brown Bessemer Hematite. Caving system of mining is used. Greatest vertical depth about 90 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1906— 12,001 tons 1907— 22,040 tons 1908— 14,030 tons

1909— 46,651 tons 1910— 21,700 tons

Total, Tons .......116,422

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Lose 49.30 .032 20.90 1.69

The Ore in its natural state is as follows:

Moist Iron Phos. Silica .029 9.00 44.86 19.19

# LA RUE MINE.

Location: Itasca County, Minnesota, Section 29 and 32, Township 57, Range 22 West.

Description: First opened up in 1903. Two ores are shipped from this mine, LA RUE, a soft, red Bessemer Hematite; and NASHWAUK, a soft, red Non-Bessemer Hematite. Steam shovel system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1903— 53,335 tons 1904—105,170 tons 1905—197,192 tons 1907—301,522 tons 1908— 79,313 tons 1909—365,543 tons 1910-128,658 tons 1906-175,670 tons

Total, Tons ......1,406,403

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

La Rue:

Alum. Magnes. Iron Phos. Silica Mang. Lime Sulph. Loss .040 57.00 12.26 .97 1.52 .21 .18 .032 2.35

Nashwauk:

Phos. Silica Mang. Alum. Lime Magnes. Iron Sulph. Loss .35 4.15 55.30 .053 13.66 .15 .12 .011 7.77

The Ore in its natural state is as follows:

La Rue:

Moist Iron Phos. Silica 8.00 52.44 .037 11.28

Nashwauk:

Moist Iron Phos. Silica 9.27 50.17 .048 12.39

# LAURA MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1902. The ore is a soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 220 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

The mine is owned by the Inland Steel Company.

Yearly Shipments:

 1902— 16,453 tons
 1907—149,410 tons

 1903— 79,286 tons
 1908—176,725 tons

 1904— 3,778 tons
 1909—178,110 tons

 1905— 27,207 tons
 1910—189,046 tons

1906—138,001 tons
Total, Tons ......958,016

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 55.30 .080 8.90 1.05 1.75

The Ore in its natural state is as follows:

Moist Iron Phos. Silica Mang. 13.75 47.70 .069 7.68

### LEETONIA MINE.

Location: St. Louis County, Minnesota, Section 10, Township 57, Range 21.

Description: First opened up in 1902. The ore is a soft, yellow Non-Bessemer Hematite. Underground and open pit systems of mining are used. Greatest vertical depth 100 feet. The ore is shipped via the Great Northern Railway to Superior and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 28,784 tons 1907—301,368 tons 1903—200,163 tons 1908—289,490 tons 1904—228,536 tons 1909—553,162 tons 1905—352,004 tons 1906—308,989 tons

Total, Tons ......2,877,892

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 59.08 .056 5.16

Moist Iron Phos. Silica 12.97 51.42 .049 4.49

### LEONARD MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

Description: First opened up in 1903. The ore is a soft Non-Bessemer Hematite which goes into Groups 3 and 7. Underground and open pit systems of mining are used. Greatest vertical depth is 253 feet.

The ore is shipped via the Duluth, Missabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1903— 10,591 tons 1907—137,316 tons 1904—151,952 tons 1908— 1905—297,011 tons 1909— 6,857 tons 1906—254,368 tons 1910—987,910 tons Total, Tons ......1,846,005

See Analysis of Groups Nos. 3 and 7.

# LILEY MINE.

Location: St. Louis County, Minnesota, Section 16, Township 58, Range 17.

Description: First opened up in 1907. Ore from this mine is called ALBERTA. It is a soft, blue black Bessemer and Non-Bessemer Hematite. Caving system of mining is used. Greatest vertical depth 110 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907— 31,032 tons 1909— 1908— 51,143 tons 1910— 25,404 tons Total, Tons .......107,579

### LINCOLN MINE.

Location: St. Louis County, Minnesota, Sections 4 and 5, Township 58, Range 17.

Description: First opened up in 1902. This mine ships DOUG-LAS ore, a soft, brown Bessemer Hematite. Slicing system of mining is used. Greatest vertical depth is 237 feet.

The ore is shipped via the Duluth, Missabe & Northern Rail-

way to Duluth and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 87,908 tons 1907—297,870 tons 1903—279,399 tons 1908—379,219 tons 1904—153,822 tons 1905—275,777 tons 1910—318,912 tons 1906—367,192 tons

Total, Tons ......2,463,165

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss

58.09 .031 12.55

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 7.86 53.52 .029 11.56

#### LONGYEAR MINE.

Location: St. Louis County, Minnesota, Section 5 and 6, Township 57, Range 20.

Description: First opened up in 1902. The ore is a soft Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth 100 feet.

The ore is shipped via the Great Northern Railway to Superior and from there by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1902— 22,788 tons 1904— 221 tons 1903— 81,604 tons 1905— 16,778 tons Total, Tons ......121,391

### MADERIA MINE.

Location: St. Louis County, Minnesota, Section 36, Township 58, Range 21.

Description: First opened up in 1910. The ore is a soft, dark brown Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 100 feet.

The ore is shipped via the Great Northern Railway to Allouez

Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1910— 83,922 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

Dried at 212° F. lows:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss .044 61.50 5.67 .82 1.50 .18 .20 .012 3.40

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.50 55.04 .039

# MAHONING MINE.

Location: St. Louis County, Minnesota, Sections 1 and 2, Township 57 North, Range 21 West.

**Description:** First opened up in 1895. Three ores are shipped from this mine, MAHONING, a Bessemer Hematite; and BEAVER and STOCK, both Non-Bessemer Hematites. Open pit system of mining is used. Greatest vertical depth is 125 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1	895— 117,884	tons		1903—1,009,446 tons
1	896— 167,245	tons		1904— 706,325 tons
1	897— 519,892	tons		1905—1,011,661 tons
1	898 520,751	tons		1906—1,274,232 tons
1	899— 750,341	tons		1907—1,564,336 tons
1	900 911,021	tons		1908— 611,592 tons
1	901— 765,872	tons		1909—1,561,893 tons
1	902-1,038,645	tons		1910—1,515,723 tons
		Total,	Tons	14,046,855

The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Mahoning:

Iron 64.00	Phos. .047	Silica 2. <b>70</b>	Mang. .76	Alum. 1.66	Lime .20	Magnes.	Sulph005	Loss 3.07
Beaver: Iron 63.02	Phos081	Silica 3.01	Mang. .42	Alum. 1.31	Lime .11	Magnes.	Sulph.	Loss 4.61
Stock: Iron 57.20	Phos.	Silica 6.30	.55	1.97	.04	.10	Sulph. .011	Loss 7.14

The Ore in its natural state is as follows:

Mahoning: Moist Iron Phos. Silica 11.21 56.83 .042 2.40

Beaver:

Phos. Silica Moist Iron 10.71 56.27 .072 2.69 Stock:

Moist Iron Phos. Silica 15.79 48.17 .084 5.31

# MALTA MINE.

Location: St. Louis County, Minnesota, Section 35, Township 58, Range 17 West.

Description: First opened up in 1899. The ore is a Bessemer Hematite. Underground system of mining is used. Greatest vertical depth is 234 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

 1899— 28,615 tons
 1905—139,853 tons

 1900— 65,346 tons
 1906—115,763 tons

 1901—126,299 tons
 1907— 82,062 tons

 1902—222,640 tons
 1908— 93,072 tons

 1903— 11,695 tons
 1909— 92,356 tons

 1904— 66,641 tons
 1910— 72,035 tons

 Total, Tons
 1,116,360

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 54.20
 .022
 19.10
 .32
 .58
 .17
 .21
 .008
 2.00

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 8.00 49.86 .020 17.57

#### MARISKA MINE.

**Location:** St. Louis County, Minnesota, Section 24, Township 58. Range 17.

Description: First opened up in 1907. The ore is a soft, red, Non-Bessemer Hematite. Slicing system of mining is used. Greatest vertical depth 208 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the Lower Lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907— 137 tons 1909— 77,690 tons 1908— 30,226 tons 1910— 23,265 tons Total, Tons ......131,318

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.34 054 12.99 .30

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.35 50.26 .047 11.39

### McKINLEY MINE.

Location: St. Louis County, Minnesota, Section 8, Township 58, Range 16.

**Description:** First opened up in 1907. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1907— 17,705 tons 1908— 1,399 tons 1909- 89,981 tons

1910--

Total, Tons ......109,086

# MEADOW MINE.

Location: St. Louis County, Minnesota, Section 3, Township 58, Range 15.

Description: First opened up in 1910. The ore is a soft, red Non-Bessemer Hematite. The caving and slicing system of mining is used. The greatest vertical depth is 250 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agent: W. G. Polfock, Cleveland.

Yearly Shipments:

1910— 4,392 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss

54.41 .073 11.94

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.24 47.20 .063 10.36

### MILLER MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description: First opened up in 1904. The ore is a soft, brown Non-Bessemer Hematite. Underground system of mining is used

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: The LaBelle Iron Works, Steubenville, Ohio.

Yearly Shipments:

 1905—118,520 tons
 1908—224,321 tons

 1906—234,071 tons
 1909—277,119 tons

 1907—279,453 tons
 1910—216,263 tons

Total, Tons ......1,349,747

Analysis: The average of all cargo analysis for 1910 is as follows: Delia at 212° F

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 59.01
 .082
 5.30
 .78
 2.48
 6.53

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.80 53.23 .074 4.78

#### MINNEWAS MINE.

Location: St. Louis County, Minnesota, Section 16, Township 58, Range 17.

**Description:** First opened up in 1893. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1893— 13,858 tons 1898— 525 tons 1894— 2,140 tons 1910— 963 tons

Total, Tons ........17,486

# MINORCA MINE.

Location: St. Louis County, Minnesota, Sections 4 and 5, Township 58, Range 17 West.

Description: First opened up in 1902. The ore is a Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 86 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1902— 35,499 tons 1907—154,661 tons 1903—115,886 tons 1908— 80,330 tons 1904—121,739 tons 1905—117,653 tons 1906—155,541 tons

Total, Tons ......966,974

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 11.97 .26 3.36 56.90 .036 1.20 1.08 .30 .007

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 6.50 53.20 .034 11.19

### MOHAWK MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 15 West.

Description: First opened up in 1906. The ore is Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 186 feet.

The ore is shipped via the Duluth & Iron Range Railway to

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1906— 92,715 tons 1909—216,291 tons 1907—128,870 tons 1910—123,180 tons 1908—119,439 tons

Total, Tons ......680,495

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Alum. Lime Magnes. Sulph. Iron Phos. Silica Mang. Loss 7.83 .76 2.36 57.40 .084 .24 .28 .008 6.02

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.50 50.23 .074 6.85

#### MONICA MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 16.

Description: First opened up in 1909. The ore is a soft, red Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 180 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

The mine is operated by the Republic Iron & Steel Company.

Yearly Shipments:

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.87 .036 12.23 .34

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.00 51.18 .032 11.00

#### MONROE MINE.

Location: St. Louis County, Minnesota, Section 28, Township 58, Range 20.

**Description:** First opened up in 1905. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905— 13,730 tons 1906—310,839 tons 1907—156,809 tons 1908— 1909—147,521 tons 1910—

Total, Tons ..........628,899

# MORRIS MINE.

Location: St. Louis County, Minnesota, Section 31 and 32, Township 58, Range 20.

**Description:** First opened up in 1905. The soft, yellowish red Non-Bessemer ore goes into Groups 3 and 7, and the yellow Bessemer ore goes into Groups 2 and 5. Open pit system of mining is used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905—1,070,937 tons 1906—1,809,743 tons 1907—2,076,388 tons 1908— 528,154 tons 1909—1,831,187 tons 1910—1,364,673 tons

Total, Tons ......8,681,082

See Analysis of Groups Nos. 2, 3, 5 and 7.

# MOUNTAIN IRON (formerly Aetna) MINE.

**Location:** St. Louis County, Minnesota, Section 3, Township 58, Range 18.

Description: First opened up in 1892. The ore is Bessemer and Non-Bessemer Hematite. The open pit system of mining is used.

This mine is operated by The Oliver Iron Mining Co.

Yearly Shipments:

1892-4,245 tons 1902—1,617,772 tons 1903-1,348,714 tons 1893— 121,463 tons 1894— 573,440 tons 1904—1,168,855 tons 1895— 371,274 tons 1905-2,495,089 tons 1896— 159,744 tons 1906—2,563,111 tons 1907—1,973,519 tons 1908— 206,698 tons 1909— 1897— 773,538 tons 1898— 650,955 tons 1899—1,137,970 tons 1910— 1900—1,001,324 tons 1901—1,058,160 tons Total, Tons .....17,198,871

# MYERS MINE.

Location: St. Louis County, Minnesota, Section 22, Township 58, Range 20.

Description: First opened up in 1905. The ore is a dark, brown, Bessemer Hematite and goes into Group 2. Underground system of mining is used. Greatest vertical depth is 206 feet. The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth and from there by boat to the lower lake ports. The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1905—188,568 tons 1908—150,249 tons 1906—228,451 tons 1909—193,698 tons 1907—153,770 tons 1910—131,440 tons Total, Tons .....1,046,176

See Analysis of Group No. 2.

### NASSAU MINE.

Location: St. Louis County, Minnesota, Section 5, Township 57, Range 20.

**Description:** First opened up in 1907. The ore is soft, red Non-Bessemer Hematite. Underground system of mining is used. Greatest vertical depth is 180 feet.

. The ore is shipped via the Duluth, Messabe & Northern and the Great Northern Railways to Duluth and Superior and from these docks by boat to the lower lake ports.

Sales Agent: W. G. Pollock, Cleveland.

Yearly Shipments:

1907— 19,172 tons 1909— 11,940 tons 1908— 1910— 39 tons

### ONONDAGA MINE.

Location: St. Louis County, Minnesota, Section 4, Township 58, Range 17.

**Description:** First opened up in 1907. The ore is soft, grey, silicious Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 127 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1907— 521 tons 1909— 59,389 tons 1908— 30,887 tons 1910— 61,935 tons Total, Tons ......152,732

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 53.93 .019 19.90 2.85

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 7.35 49.97 .018 18.44

### PEARCE MINE.

Location: St. Louis County, Minnesota, N. E. 1/4 of N. W. 1/4, Section 28, Township 58, Range 20.

Description: First opened up in 1902. The ore is soft, dark brown Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 110 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1902— 54,884 tons 1903— 50,204 tons 1904— 235 tons 1905— 1906— 65,682 tons 1909— 1910— 60,411 tons

700— 05,082 tons Total, Tons ......303,241

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Phos. Silica Mang. Iron Alum. Lime Magnes. Sulph. Loss 59.67 .045 7.26 .82 1.74 .20 .22 .010

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.50 54.00 .041 6.57

### PEARSON MINE.

**Location:** Itasca County, Minnesota, Section 29, Township 57, Range 22.

Description: First opened up in 1909. The ore is soft, brown Bessemer Hematite. Caving system of mining is used. The greatest vertical depth is 150 feet.

greatest vertical depth is 150 feet. The ore is shipped by the Great Northern Railway to Allouez Bay and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 68,683 tons 1910— 78,133 tons Total, Tons ......146,816

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 15.42 1.02 .23 .009 2.96 54.60 .036 1.62 .24

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.00 49.69 .033 14.03

### PENOBSCOT MINE.

Location: St. Louis County, Minnesota, Section 1, Township 57, Range 21.

**Description:** First opened up in 1897. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1897— 11,933 tons 1901—221,080 tons 1898— 29,652 tons 1902—209,531 tons 1899— 85,619 tons 1900—146,641 tons

Total, Tons ......706,071

## PERKINS MINE.

Location: St. Louis County, Minnesota, Section 26, Township 59, Range 15.

Description: First opened up in 1909. The ore is soft, brown Non-Bessemer Hematite. Open pit system of mining is used. The greatest vertical depth is 120 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 59,029 tons 1910— 80,622 tons Total, Tons ......139,651

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.50 .084 6.88 .36 2.01 .32 .26 .011 6.27

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.00 50.90 .073 5.99

#### PETTIT MINE.

Location: St. Louis County, Minnesota, Section 25, Township 58, Range 17.

Description: First opened up in 1902. The ore is soft, red Non-Bessemer Hematite. Slicing system of mining is used. The greatest vertical depth is 244 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

 1902— 17,278 tons
 1907— 36,074 tons

 1903— 52,706 tons
 1908— 57,140 tons

 1904— 27,088 tons
 1909— 83,548 tons

 1905—140,239 tons
 1910— 62,456 tons

 1906— 82,757 tons

Total, Tons .......559,286

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 56.12
 .061
 11.12
 .43
 2.32
 .34
 .20
 .011
 4.70

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.60 47.93 .052 9.50

### PILLSBURY MINE.

**Location:** St. Louis County, Minnesota, Section 29, Township 58, Range 20.

Description: First opened up in 1898. The ore is Bessemer and Non-Bessemer Hematite. The open pit system of mining is used.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1898— 99,691	tons	1904
1899—106,487	tons	1905-161,924 tons
1900—101,032	tons	1906— 33,546 tons
1901—120,723	tons	1907—489,718 tons
1902—238,122		1908— 59,889 tons
1903—229,133	tons	

Total, Tons ......1,640,265

### ROBERTS MINE.

Location: St. Louis County, Minnesota, S. W. 1/4 of N. W. 1/4, Section 8, Township 58, Range 16.

Description: First opened up in 1897. The ore is soft, brown Bessemer Hematite. The caving system of mining is used. The greatest vertical depth is 65 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1897— 18,614	tons	1904
1898—		1905
1899 57,847	tons	1906—
1900-41,965	tons	1907—
1901— 42,756	tons	1908—
1902- 28,972	tons	1909—
1903		1910— 26,915 tons
	m . 1 m	217 060

Total, Tons ......217,069

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 54.69 .033 16.37 .55

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.50 49.49 .030 14.81

#### SAUNTRY ALPENA MINE.

Location: St. Louis County, Minnesota, Section 5, Township 58, Range 17.

**Description:** First opened up in 1898. The ore is Bessemer and Non-Bessemer Hematite.

The mine is operated by The Oliver Iron Mining Company.

Yearly Shipments:

1898— 53,004 tons 1901—249,837 tons 1899— 68,560 tons 1910—242,373 tons 1900—328,739 tons

Total, Tons ......942,513

#### SCHLEY MINE.

Location: St. Louis County, Minnesota, Section 25, Township 58, Range 17.

Description: First opened up in 1910. The ore is soft, red, Bessemer and Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 160 feet. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Company, Cleveland.

Yearly Shipments:

1910— 13,369 tons

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 58.00 .080 .50

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 12.00 51.04 .070

### SCRANTON (Formerly Elizabeth) MINE.

Location: St. Louis County, Minnesota, Section 12, Township 57, Range 21.

**Description:** First opened up in 1904. The ore is Non-Bessemer Hematite. Underground system of mining is used.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1904— 1,168 tons 1905-19091910— 7,214 tons

Total, Tons .........8,382

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 56.50 .073 8.03 1.05 3.20 .17 .22 .010 6.27 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.50 50.00 .065 7.11

#### SELLERS MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57, Range 20.

Description: First opened up in 1895. The ore is a soft brownish and grayish black Bessemer Hematite, and goes into groups 2 and 5. Open pit system of mining is used. The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1895— 47,433 tons 1903—251,631 to	ns
1896— 153,037 tons 1904—207,990 to	ns
1897— 1905—261,501 to	ns
1898—112,765 tons 1906—241,031 to	ns
1899—174,867 tons 1907—155,060 to	
1900— 56,280 tons 1908—354,780 to	
1901— 34,918 tons 1909—626,169 to	
1902—193,428 tons 1910—954,042 to	
Total, Tons3,824,932	

See Analysis of Groups Nos. 2 and 5.

#### SEVILLE MINE.

Location: St. Louis County, Minnesota, Section 10, Township 58, Range 19.

**Description:** First opened up in 1909. This mine ships MADEIRA ore, a soft, red, Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 180 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1909— 23,585 tons 1910— 2,677 tons
Total, Tons ..........26,262

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Silica Iron Phos. Mang. Alum. Lime Magnes. Sulph. Loss 1.50 .18 .20 61.50 .044 5.67 .82 .012 3.40

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.50 55.04 .039 5.07

#### SHARON MINE.

Location: St. Louis County, Minnesota, Section 20, Township 58, Range 19.

Description: First opened up in 1901. The ore is Non-Bessemer Hematite.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1901— 56,810 tons 1902-224,526 tons

1903-48,199 tons

Total, Tons ......329,535

#### SHENANGO MINE.

Location: St. Louis County, Minnesota, Sections 22, 23 and 27, Township 58, Range 20.

**Description:** First opened up in 1902. This mine ships two ores, SHENANGO, a black, semi-hard, Bessemer Hematite, and WILPEN, a black, semi-hard, Non-Bessemer Hematite. Underground and open pit systems of mining are used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is owned by the Shenango Furnace Company.

Yearly Shipments:

60.45

1904— 51,712 tons 1905—213,097 tons 1906—383,717 tons

1908—461,887 tons 1909—831,099 tons 1910—965,148 tons

1907-387,093 tons

5.35

Total, Tons .....3,293,753

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F. Phos. Silica Mang. Iron

Alum. Lime Magnes. Sulph. Loss

The Ore in its natural state is as follows:

1.08

Moist Iron Phos. Silica 12.26 53.04 .042

.048

#### SLIVER MINE.

Location: St. Louis County, Minnesota, Sections 5 and 6, Township 58½, Range 17.

Description: First opened up in 1908. The mine ships two ores, DOVER, a soft, red, Non-Bessemer Hematite, and SLIVER MANGANESE, a soft, red, Non-Bessemer Manganiferous Hematite. Open pit system of mining is used.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1908— 49,291 tons 1909—256,073 tons

1910-358,432 tons

Total, Tons, .......663,796

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Dover:

Silica Iron Phos. Mang. Alum. Lime Magnes. Sulph. Loss 59.90 .079 5.81 .62 1.76 4.92 .20 .18 .011

Sliver Manganese:

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 59.80
 .072
 6.25
 .98
 2.34
 .27
 .21
 .012
 4.07

The Ore in its natural state is as follows:

Dover:

Moist Iron Phos. Silica 13.37 51.89 .068 5.03

Sliver Manganese:

Moist Iron Phos. Silica 13.18 51.92 .063 5.43

#### SPRING MINE.

Location: St. Louis County, Minnesota, Section 11, Township 59, Range 14.

Description: First opened up in 1906. The ore is soft, grayish, blue, Bessemer Hematite. Underground and open pit systems of mining are used. The greatest vertical depth is 120 feet. The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

1907— 15,257 tons

1909—

1908— 20,516 tons

1910— 31,909 tons Total, Tons .........67,682

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 52.22 .033 21.84

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.19 47.42 .030 19.83

#### SPRUCE MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 17.

Description: First opened up in 1894. The ore is Bessemer and Non-Bessemer Hematite, and goes into Groups 1 and 4 and Special Group 4. Underground system of mining is used. The greatest vertical depth is 281 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports. The mine is operated by the Oliver Iron Mining Company.

Yearly	Shipments:	
	1894, 5,628 tons	1903—587,153 tons
	1895— 47,700 tons	1904—589,319 tons
	1896— 96,280 tons	1905—606,295 tons
	1897— 12,215 tons	1906674,602 tons
	1898—	1907—610,457 tons
	1899— 1,621 tons	1908—430,633 tons
	1900	1909—579,903 tons
	1901—279,515 tons	1910—613,947 tons
	1902—543,203 tons	•

Total, Tons ......5,678,471.

See Analysis of Groups Nos. 1 and 4.

#### ST. CLAIR MINE.

Location: St. Louis County, Minnesota, Section 23, Township 58, Range 20.

**Description:** First opened up in 1900. The ore is Non-Bessemer Hematite.

This mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1900—101,675 tons 1903— 6,148 tons 1901— 1904— 26,748 tons 1902— 1905— 61,792 tons Total, Tons ......196,363

#### ST. JAMES MINE.

**Location:** St. Louis County, Minnesota, Section 3, Township 58, Range 15.

**Description:** First opened up in 1906. The ore is soft, blue, Non-Bessemer Hematite. The underground system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, Minn.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.65 .077 8.96 .63 2.98 .27 .16 .008 4.45 The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.75 50.88 .068 7.91

#### ST. PAUL MINE.

Location: Itasca County, Minnesota, Section 24, Township 57, Range 22.

Description: First opened up in 1905. The ore is soft, blue, Non-Bessemer Hematite. Open pit system of mining is used. The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1906— 24,230 tons 1907—113,200 tons, 19081909— 1910—

Total, Tons .......137,430

Analysis: Expected analysis for season of 1911 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Loss Sulph. 57.79 .073 2.94 4.25 8.36 .51 .23 .29 .006

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 11.65 51.06 .064 7.39

#### STEPHENS MINE.

Location: St. Louis County, Minnesota, Sections 23, 25 and 26, Township 59, Range 15.

**Description:** First opened up in 1903. The ore is Non-Bessemer Hematite.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1903— 87,055 tons

1905—367,764 tons

1904---

Total, Tons .......454,812

#### STEVENSON MINE.

Location: St. Louis County, Minnesota, Sections 7 and 8, Township 57, Range 21.

Description: First opened up in 1900. This mine ships two ores, STEVENSON, a soft, blue, Bessemer Hematite, and WALLACE, a soft, blue, Non-Bessemer Hematite. Open pit system of mining is used.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: Corrigan, McKinney & Co., Cleveland.

Yearly Shipments:

1900— 56,031 tons 1906—1,041,500 tons 1901— 666,273 tons 1907—1,142,977 tons 1902—1,434,681 tons 1908— 516,770 tons 1903—1,014,582 tons 1909—1,030,742 tons 1904—1,652,021 tons 1905—1,428,614 tons

Total, Tons .....10,937,270

Stevenso	n:								
Iron	Phos.	Silic		ang.	Alum.		Magnes.	Sulph.	Loss
61.10	.043	5.88	3	.87	.91	.76	.12	.007	3.62
Wallace:									
Iron	Phos.				Alum.		Magnes.	Sulph.	Loss
60.57	.057	6.86	5	.93	.98	.40	.25	.009	3.48
The (	Ore in	its na	tural	state	is as	follows	:		
Stevenso	n:							•	
Moist	Iron	Phos.	Silica						
9.14	55.52·	.039	5.34						
Wallace:									
Moist	Iron	Phos.	Silica						
9.78	54.65	.051	6.19						•

#### SUSQUEHANNA MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57 North, Range 20 West.

Description: First opened up in 1906. The ore is soft, red, Non-Bessemer Hematite. Slicing and caving systems of mining are used. The greatest vertical depth is 192 feet.

The ore is shipped via the Duluth, Messabe and Northern Railway to Duluth, and via the Great Northern Railway to Superior; from these points by boat to the lower lake ports.

Sales Agents: The Rogers Brown Iron Company, Buffalo, N. Y.

Yearly Shipments:

1906— 20,984 tons 1909—243,049 tons 1907—137,207 tons 1910—176,869 tons 1908—182,352 tons

Total, Tons .......760,461

#### SWEENY MINE.

Location: St. Louis County, Minnesota, Sections 3 and 4, Township 57, Range 21.

**Description:** First opened up in 1908.

The mine is operated by the Oliver Iron Mining Company.

Yearly Shipments:

1908— 7,579 tons 1910— 769 tons Total, Tons ......8,348

#### TROY MINE.

Location: St. Louis County, Minnesota, Section 7, Township 57, Range 17 West.

**Description:** First opened up in 1903. The ore is a Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 125 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the Lower Lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

 1903— 15,099 tons
 1907—100,730 tons

 1904— 12,759 tons
 1908— 40,283 tons

 1905— 87,584 tons
 1909— 86,520 tons

 1906—146,849 tons
 1910—104,057 tons

Total, Tons ......593,881

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 51.40
 .043
 16.68
 1.08
 1.48
 .48
 .88
 .246
 5.15

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.00 44.20 .037 14.34

#### UNION MINE.

**Location:** St. Louis County, Minnesota, Section 9, Township 58, Range 17.

Description: First opened up in 1900. The ore is soft, red, Bessemer and Non-Bessemer Hematite. Open pit system of mining is used. The greatest vertical depth is 204 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the Lower Lake Ports.

Sales Agents: Oglebay, Norton & Co., Cleveland.

Yearly Shipments:

 1900—
 8,297 tons
 1905—

 1901—
 93,109 tons
 1906—
 20,691 tons

 1902—103,522 tons
 1907—
 61,825 tons

 1903—
 91,496 tons
 1908—
 20,937 tons

 1904—

Total, Tons ......399,877

#### UTICA MINE.

Location: St. Louis County, Minnesota, Sections 2 and 11, Township 57, Range 21 West.

Description: First opened up in 1902. There are two ores shipped from this mine, ALBANY, a Non-Bessemer Hematite; and CRETE, a Bessemer Hematite. The open pit and underground systems of mining are now being used. The greatest vertical depth is 150 feet.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

Yearly Shipments:

1902— 9,009 tons 1907-304,864 tons 1903—156,180 tons 1904—120,697 tons 1905—185,944 tons 1908— 57,194 tons 1909-201,480 tons 1910-232,582 tons

1906-268,281 tons

Total, Tons ......1,536,231 Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Albany:

Iron Phos. Silica Lime Magnes. Mang. Alum. Sulph. Loss 58.20 .074 6.04 .88 2.44 6.55 .21 .23 .010

Crete:

Iron Phos. Silica Mang. Alum. Magnes. Lime Sulph. 59.35 .057 5.47 .44 1.03 .20 .24 7.55 .007

The Ore in its natural state is as follows:

Albany:

Moist Iron Phos. Silica 12.50 50.93 .065

Crete:

Phos. Silica Moist Iron 11.80 52.35 .050 4.83

#### VICTORIA MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17.

**Description:** First opened up in 1906. The ore is soft, red, Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 167 feet.

The ore is shipped via The Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1906— 64,820 tons 1907— 90,090 tons 1908— 21,310 tons 1909—113,305 tons 1910— 27,592 tons

Total, Tons ......317,117

Analysis: The average of all cargo analysis for 1910 is as fol-Dried at 212° F. lows:

Iron Silica Phos.

Mang. Alum. Lime Magnes. Sulph. Loss .058 7.08 60.48

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.70 54.61 .052

#### VIRGINIA MINE.

St. Louis County, Minnesota, Section 30, Township Location: 58, Range 17.

**Description:** First opened up in 1910. This mine ships two ores, VIRGINIA BESSEMER HEMATITE and VIRGINIA NON-BESSEMER HEMATITE: Open pit system of mining is used.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Company, Cleveland.

### Yearly Shipments:

1910-299,046 tons

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Virginia Bessemer:

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 57.10
 .037
 8.84
 .98
 1.72
 .41
 .43
 .345
 5.19

Virginia Non-Bessemer:

Alum. Magnes. Sulph. Iron Phos. Silica Mang. Lime Loss 55.90 .421 6.09 .066 8.55 1.30 2.48 .34 .51

The Ore in its natural state is as follows:

Virginia Bessemer:

Moist Iron Phos. Silica 12.00 50.25 .033 7.78

Virginia Non-Bessemer:

Moist Iron Phos. Silica 12.00 49.19 .058 7.52

#### VIRGINIA MINE.

Location: St. Louis County, Minnesota, Sections 8 and 9, Township 58, Range 17.

Description: First opened up in 1893. The ore is a soft, Bessemer and Non-Bessemer Hematite, and goes into Groups 2, 3 and 7. Underground and open pit systems of mining are used. The greatest vertical depth is 341 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

CITTAL	· CIIC					
1893	123,015	tons		1902	5,131	tons
1894	544,954	tons		1903—	5,866	tons
1895	622,712	tons		1904—	5,395	tons
1896	955,739	tons		1905	402,224	tons
1897	749,499	tons		1906—	5,674	tons
1898	560,848	tons		1907—1	,015,717	tons
1899	293,651	tons		1908		
1900—	417,473	tons		1909—1	,843,450	tons
1901	5,420	tons		1910—	985,163	tons
		Total,	Tons	9,203,260	1	

See Analysis of Groups Nos. 2, 3 and 7.

#### WACOOTAH MINE.

Location: St. Louis County, Minnesota, Sections 3 and 11, Township 58, Range 18 West.

Description: First opened up in 1906. The ore is a soft, brown, Non-Bessemer Hematite. Open pit system of mining is used. The ore is shipped via the Duluth, Messabe & Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1906— 6,766 tons 1907—158,692 tons 1908— 1909— 60,966 tons 1910— 35,498 tons

Total, Tons ......261,922

Analysis: The average of all cargo analysis for 1910 is as fol-

lows: Dried at 212° F.

 Iron
 Phos.
 Silica
 Mang.
 Alum.
 Lime
 Magnes.
 Sulph.
 Loss

 53.77
 .057
 9.37
 .66
 5.78
 none
 none
 .412
 5.20

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 10.83 49.95 .051 8.36

#### WEBB MINE.

Location: St. Louis County, Minnesota, Section 6, Township 57, Range 20.

**Description:** First opened up in 1905. The ore is a reddish brown, semi-hard Bessemer and Non-Bessemer Hematite. Underground system of mining is used. The greatest vertical depth is 220 feet.

The ore is shipped via the Great Northern Railway to Allouez Bay, and from there by boat to the lower lake ports.

This mine is owned by the Shenango Furnace Company.

Yearly Shipments:

1905— 71,235 tons 1908— 19,610 tons 1906—165,604 tons 1909— 1907—113,334 tons 1910— 46,384 tons Total, Tons .......416,167

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Bessemer:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 55.00 .047 15.00 1.00

Non-Bessemer:

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.00 .100 7.00 1.00

The Ore in its natural state is as follows:

Bessemer:

Moist Iron Phos. Silica 12.00 48.40 .042 13.20

Non-Bessemer:

Moist Iron Phos. Silica 14.00 49.02 .086 6.02

#### WHITESIDE MINE.

Location: St. Louis County, Minnesota, Section 15, Township 58, Range 19.

Description: First opened up in 1909-1910. This mine ships WILPEN ore, a brown, semi-hard, Bessemer Hematite. Underground system of mining is used. 'The greatest vertical depth is 230 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports.

The mine is owned by the Shenango Furnace Company.

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 57.00 .100 7.00 1.00

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 14.00 49.02 .086 6.02

#### WILLIAMS MINE.

Location: St. Louis County, Minnesota, Section 2, Township 58, Range 16.

Description: First opened up in 1895. The ore is a soft, dark brown, Bessemer and Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 105 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: The Thomas Furnace Co., Milwaukee, Wis.

Yearly Shipments:

 1895— 3,046 tons
 1903—

 1896— 11,249 tons
 1904—

 1897—
 1905—

 1898—
 1906— 17,685 tons

 1899— 12,357 tons
 1907— 35,267 tons

 1900— 1901—
 1909—

Total, Tons .......97,842

#### WILLS MINE.

Location: St. Louis County, Minnesota, Sections 17 and 18. Township 58, Range 16.

Description: First opened up in 1902. The ore is a soft, red. Non-Bessemer Hematite. The slicing system of mining is used. The greatest vertical depth is 86 feet.

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1902— 12,158 tons 1903—	1907— 1908—
1904	1909— 3,44') tons
1905— 4,550 tons	1910— 26,712 tons
1906—	

Total, Tons ........46,860

**Analysis:** The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Iron Phos. Silica Mang. Alum. Lime Magnes. Sulph. Loss 54.00 .062 12.95 1.92 1.70 .09 .36 .017 5.76

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 9.83 49.23 .056 11.80

#### WINIFRED MINE.

Location: St. Louis County, Minnesota, Section 31, Township 58, Range 20.

Description: First opened up in 1903. The ore is soft, reddish brown, Bessemer and Non-Bessemer Hematite and goes into Groups 2, 3, 5 and 7. Underground system of mining is used. The greatest vertical depth is 165 feet.

The ore is shipped via the Duluth, Messabe & Northern Railway to Duluth, and from there by boat to the lower lake ports

This mine is operated by the Oliver Iron Mining Co.

Yearly Shipments:

1903— 39,179 tons		1907— 94,867 tons
1904— 81,686 tons		1908— 61,341 tons
1905—		1909— 84,614 tons
1906— 3,415 tons		1910— 67,686 tons
Total	Tone	432 788

See Analysis of Groups Nos. 2, 3, 5 and 7.

#### YATES MINE.

Location: St. Louis County, Minnesota, Section 11, Township 58, Range 19.

Description: First opened up in 1904. The ore is a soft, red, Non-Bessemer Hematite. Underground system of mining is used.

The ore is shipped via the Great Northern Railway to Superior, and from there by boat to the lower lake ports.

Sales Agents: M. A. Hanna & Co., Cleveland.

Yearly Shipments:

1904— 53,179 tons 1907—210,289 tons 1905— 58,174 tons 1908— 86,308 tons 1906—265,289 tons Total, Tons ........679,038

#### YAWKEY MINE.

Location: St. Louis County, Minnesota, Section 9, Township 58, Range 17 West.

Description: First opened up in 1907. The ore is Non-Bessemer Hematite. The underground system of mining is used. The greatest vertical depth is 137 feet.

The ore is shipped via the Duluth & Iron Range Railway to

The ore is shipped via the Duluth & Iron Range Railway to Two Harbors, and from there by boat to the lower lake ports.

Sales Agents: Pickands, Mather & Co., Cleveland.

Yearly Shipments:

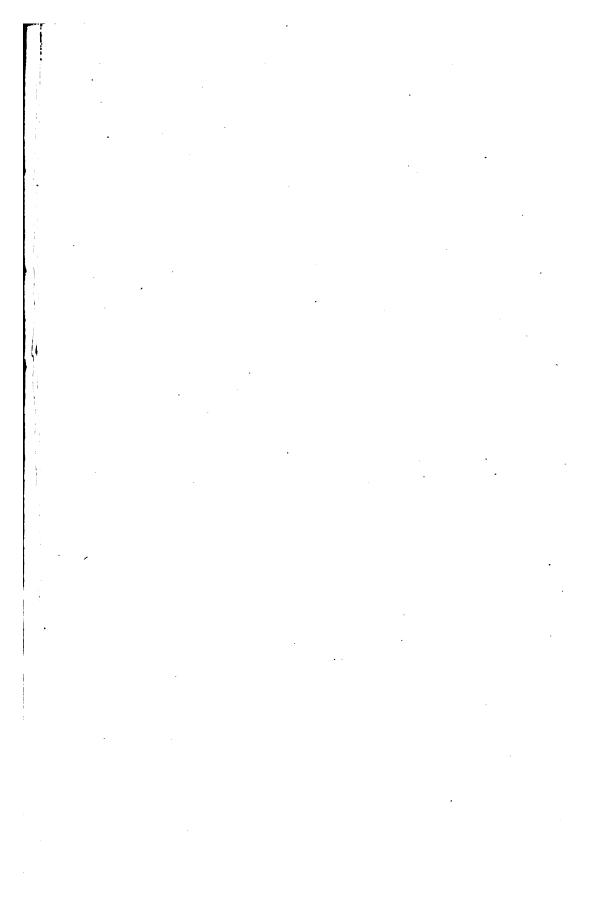
1907— 15,453 tons 1909— 45,790 tons 1908— 84,446 tons 1910— 30,439 tons Total, Tons ......176,128

Analysis: The average of all cargo analysis for 1910 is as follows: Dried at 212° F.

Silica Lime Magnes. Sulph. Iron Phos. Mang. Alum. Loss 7.38 54.60 .083 10.58 .82 2.23 .31 .19 .012

The Ore in its natural state is as follows:

Moist Iron Phos. Silica 13.80 47.07 .072 9.12



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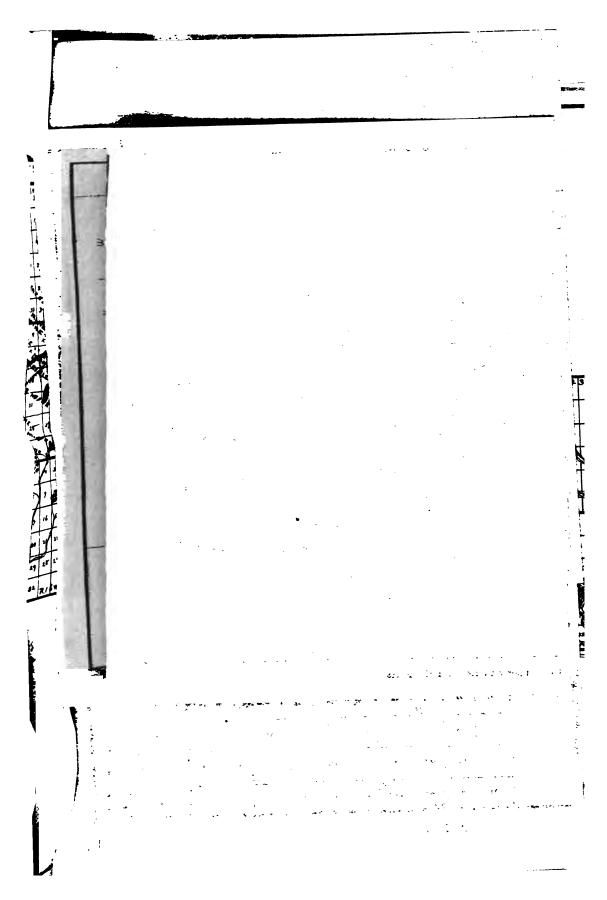
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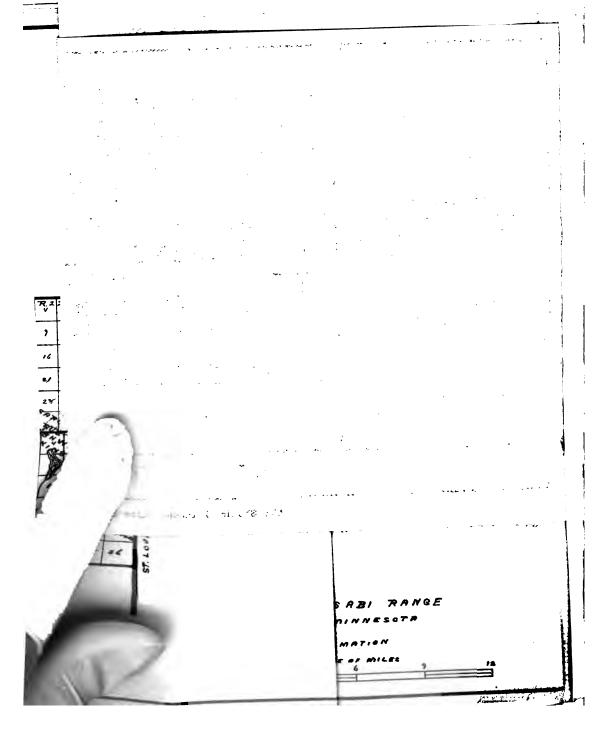
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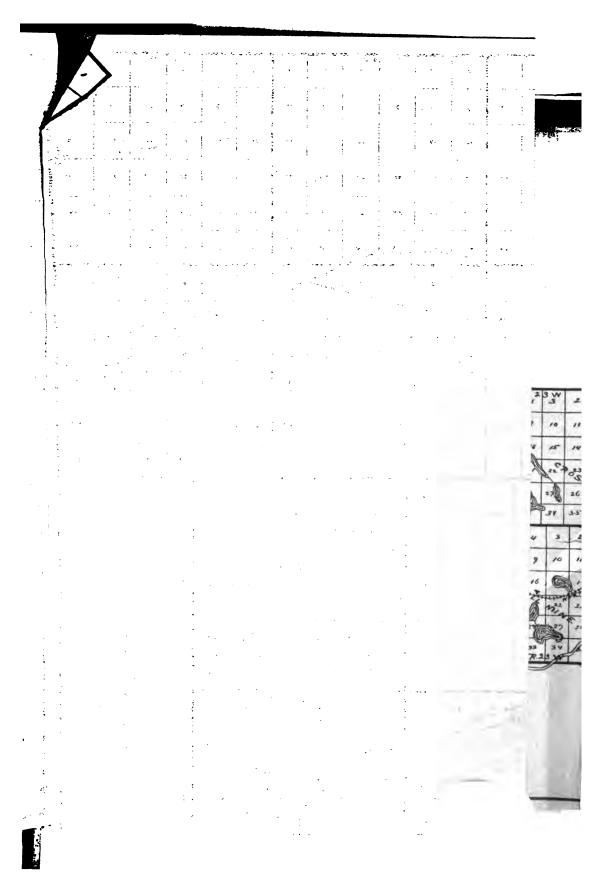


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